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WE GUARANTEE, that of this issue 6,300 copies were printed; that of these 6,300 copies, 4,388 were mailed to regular paid subscribers, 523 were provided for counter and news company sales, 275 were mailed to advertisers, 37 were mailed to employes and correspondents, and 1,077 were provided for new subscriptions, samples, copies lost in the mail and office use; that the total copies printed this year to date were 70,800—an average of 7,800 copies a month.

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Protection or Subsidies

THE sole reason that an increasing number of American ships are being tied up and that the percentage of the traffic carried in our vessels is steadily decreasing is the lack of a shipping policy embracing the discriminatory features of the Jones Act or an equivalent subsidy. No matter how efficient a Shipping Board may be, no matter if the most experienced practical men direct our vessels, the fact remains that the cost of operating ships under the various flags varies almost directly as the cost of living in the respective countries.

It is no more feasible to expect our seamen to accept a foreign standard of wages or living than it would be to get this concession from any other class of American labor; but even if it were possible, the wages are but a small percentage of the operating costs which are affected by the cost of living in this country. It is therefore just as well that capital has refrained from investing liberally in American shipping because if it had there would have been such a number of failures in the last six months that it would have taken years for our merchant marine to get over it.

Private capital as a rule has to be shown that there is a reasonable chance of profit before it can be interested but it is always on watch for opportunities. Our pioneer purchasers thought there was an opportunity for they were not informed that the Merchant Marine Act was not to be enforced. Had it been enforced, they would have been justified and the propaganda that the Government ships cannot be sold at any price would never have been started.

We may sink, sell, or sail our ships but we must pay a subsidy on our commerce, call it by whatever name you please. From 1870 to 1890 we paid foreign shipowners $3,170,000,000 for carrying the goods which our own merchant marine was unable to take. The year before the war we donated to foreign shipping $390,000,000 and last year this sum was estimated at over $700,000,000. Shall we continue to pay this enormous tribute to foreign vessels, shall we protect our shipping by the discriminatory provisions of the Jones Act or shall we grant an equivalent direct subsidy?

A decision one way or the other cannot be evaded much longer. The tariff is a protection to all industries but shipping, it increases the cost of operating our vessels and it restricts imports, preventing full return cargoes. Why then, as long as we have a tariff, should we not enforce the differential in favor of American vessels? It would automatically add a billion dollars to the value of the Government fleet and it would encourage the construction and operation of passenger liners. Passenger ships are needed badly to balance our fleet, to carry our mails, to educate cadets in engineering and navigation, to be at the disposal of the Government in case of need as transports and to increase our commercial relations with foreign countries by furnishing regular and speedy connections for cargoes and merchants. And in addition to this, they will help to establish a market for bulk commodities which will follow in the slower and less expensive cargo ships.

The Leviathan

ON page 735 of this issue, a complete description is given of the world's largest boat, the *Majestic,* which will join the White Star fleet of Atlantic liners next spring. With the *Imperator* sailing under the Cunard emblem, but one of the trio of the finest and largest ex-German ships remains in useless condition rotting at its dock and that one is the *Leviathan,* whose misfortune it is to fly the American flag.

The propaganda has gone out that these big ships do not pay except, possibly, as an advertisement for the line on which they run and Congress must have swallowed this illusion, line, hook and sinker, or it would have insisted on

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the reconditioning and commissioning of this vessel long ago. Take the *Olympic,* for example; on her last trip she carried over 1,000 first and second-class passengers to England and brought back 770 first-class and 505 second-class, to say nothing of steerage passengers. If anyone thinks that with the rate that you have to pay to travel on the few boats of this type, which you can number on the fingers of one hand, the "ewe lamb" of the White Star fleet is not netting hundreds of thousands of dollars of profit on each round trip except in the winter season, then they lack common sense. If the truth was published, it is a safe bet that this ship is making good any losses occurring in the operation of the smaller vessels.

Suppose the *Leviathan* was in commission on an American line. Outside of the people interested in shipping or living in Atlantic seaports, the *Leviathan,* with the possible exception of the *George Washington,* is the only American transatlantic liner that is really known. A trip abroad is a big event for most everyone and many people would consider it well worth the extra fare that this ship would charge to be able to say on their return that they went at least one way on the *Leviathan.* Not only this, but the *Leviathan* could on account of its size, furnish many extra inducements and luxuries that are not possible in smaller ships. That this is not idle talk is proven by the fact that in spite of the extra fare the demand for accommodation is greatest on the big ships.

The *Leviathan* should be in service next spring and it could be if we were in earnest about it. The *George Washington,* efficiently reconditioned in ninety days, proves that. How can we get action on this big ship? Public opinion would not allow it to be sunk, which, after all, would be more sensible than letting it rot. We ask our readers to use their ingenuity on this problem. How about asking two friends, either by word or by letter, to each send one vote to their Congressman on the subject and pass it along to two more a la endless chain?

The Bare-Boat Charter

WHILE it is undesirable to continue the system of allocating Government vessels to operators on the M.O.4 agreement, whereby the operator receives a percentage of the gross freights whether the voyage is successful or otherwise, any longer than absolutely necessary, the Shipping Board should and probably will give very careful consideration to the claims of the operators before compelling them at this time to change over to a bare-boat or partnership system.

Undoubtedly there are many routes that cannot be made to pay until trade conditions are better, therefore where there is no reason to suspect that an operator is dishonest, careless or negligent, the Board should go as far as it possibly can to hold up the berth until it can be proved that the losses are avoidable. Many routes that are losing money today will be an asset when trade is revived, perhaps after a very few more voyages. No doubt there have been cases where the Government has been cheated or at least its interests ignored but the fact that Mr. Smull has never heard of a case where concerns who both own and charter ships have tied up their own ships when there was a shortage of freight to operate Government vessels where there was no chance for them to lose proves ship operators are at least as honest as any other class of men.

It would seem, however, that just as soon as the traffic warrants a bare-boat charter should be put into effect even if the rental has to be made very low. Until this is done our shipping will remain on an artificial basis which will prevent its proper development. *Fairplay* has pointed out that with a low charter hire there is a grave danger that operators will find it more advantageous to continue chartering in preference to buying. This, however, is false reasoning for as soon as substantial profits are made at a low charter rate there will be plenty of competition that will force the rates higher and higher until they reach a point where it will be to the interest of the operator to purchase outright.

Operating Cost per Ton

ACCORDING to Mr. J. B. Smull, vice-president of the Emergency Fleet Corporation and director of operations for the Shipping Board, the cost of operating the six Government vessels, which the firm that he was connected with have been running from New York to Hull and from New York to Bristol, has been $48 per deadweight ton per year. This cost includes the overhead of the office, the 5 percent commission paid by the Shipping Board to the operator, the insurance, depreciation and all of the expenses of operating the vessels including repairs.

Mr. Smull stated that these figures should not be taken for the average rate per ton for all vessels all over the world because there is something that changes with every trade. The ships on this particular berth should make eight round trips a year and the foreign ports that they enter are not expensive. Repairs and provisions are much cheaper in England than at Alexandria, Cape Town, South America, Australia or China, and if the voyage is longer there are more repairs to be made and more provisions to be brought away from home.

Surprising as Mr. Smull's statement is, that ships running on one of the cheapest berths cost $48 a deadweight ton per year to operate, his statement that his firm was able to show a small profit at this cost on the existing freight rates and under present conditions is even more remarkable. And, still further, Mr. Smull expressed the opinion that under the present freight rates and conditions the operating cost per deadweight ton could be raised to $60 before getting on the red-ink side of the ledger.

Although Mr. Smull states that the fixed charges are included in the $48 he did not give the book value on which these charges were based. It is evident, however, from an estimate of the operating costs from other sources which, excluding fixed charges, approached very closely to $40 a deadweight ton per year, that he does not figure on much over $50 a deadweight ton as the proper value upon which to base interest, insurance and depreciation.

It would seem, therefore, that the Shipping Board, under

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present conditions, would not be justified in charging more than 50 cents a deadweight ton per month on a bare-boat charter. They probably should go lower than this on expensive berths and even take a loss on some routes but, on the whole, where due care and attention is paid to the business, there is still money to be made in shipping. When business returns to normal, as it surely will, competition will automatically increase the charter rate but as the Government has such a large number of vessels, the benefit of any increase in the volume of trade will naturally go to the ship operator until all the ships are placed in commission.

The Marine Exposition

THE Marine Exposition, which will be held at the Central Mercantile Building, New York city, during the week of November 14, 1921, under the auspices of the National Marine League and the Marine Equipment Asosciation of America, will for the first time combine the opportunity of inspecting the latest improvements in marine equipment with the privelege of attending the conventions of the Society of Naval Architects and Marine Engineers and the American Society of Marine Draftsmen.

The decision of the Marine Equipment Association of America, Woolworth Building, New York City, to hold this exposition at the same time and in conjunction with the conventions of as many marine organizations as possible means a great deal to the members of those societies. In the past many have not been able to attend both events and they have had the hard task of deciding whether it was more important for them to attend the exposition or the convention. Many others who in the past have failed to attend either will undoubtedly see in this "American Marine Week" an opportunity that they cannot afford to miss.

No one can keep up to date by sticking to his desk, neither can he progress without exchanging views with others nor in these strenuous times without knowing all about the latest types of marine equipment. Seeing is learning as well as believing and many shipping and shipbuilding companies would gain much by sending their department heads to the exposition with instructions to prepare a written report on the exhibits pertaining to their particular work.

The success of the exhibitions, however, means a great deal more than a social and educational gathering to the marine field. It is a great advertisement for the American merchant marine and one of the best ways to awaken the interest of the public in maritime affairs. The National Marine League has directed its entire efforts for several years to interesting the American people in the importance of our merchant marine and it was largely for this purpose that the first two marine expositions in New York were held. The support of the man on the street, in the factory and on the farm is needed for they hold the majority of votes and until they are convinced that the future prosperity of our country depends on the merchant marine, shipping will not get the financial and legislative backing that it should.

In order to make this exposition of the most value to the merchant marine all maritime organizations are most urgently invited to cooperate. Whether you are shipbuilders, repair men, ship owners, ship operators, shippers, underwriters, officers, engineers, or crew this is your show. Remember that this is the first time that all marine organizations have had the opportunity to work in conjunction. Shape your course now to attend this big marine event and help to make "American Marine Week" a real factor in the development of our merchant marine.

Operation Has Helped Carry Construction

ONE of the interesting facts brought out at the hearings on the Shipping Deficiency Bill before the subcommittee of the House Committee on Appropriations was "that from the inception of the Shipping Board up to February 28, 1921, the receipts from operations of vessels, voyage and charter revenue and revenues incidental to vessel operations were $1,051,893,910.04, and that the expenditures on the operation of vessels, voyage expenses, maintenance, charter hire, etc., were $777,250,380.11."

In other words, the Shipping Board, which under the last administration had five different chairmen in less than four years and part of that period only two members, actually made $275,000,000 profit from operations up to the time that the new administration took office. In addition to managing by far the largest fleet ever operated under one head, it attended to a few other trifling details, such as the construction of several million tons of new vessels. Perhaps, if the Board had not had to take this profit and the appropriations that Congress has made for the construction of new vessels, it would be on its feet today in spite of the losses made during the last year.

But it is not our object to dwell in the past. History will establish the proper credit for those who accomplished the greatest shipping achievement of all time. What we want to know is how long does the press of this country, including several marine publications, intend to keep up the propaganda that our shipping is in such a terrible condition that there is no hope for it? Why not drop this "colossal wreck" and "sick merchant marine" talk and devote the space to the ways and means of developing our foreign trade? Of what use is our surplus of money and almost every kind of raw and finished materials when millions are unemployed? We have the surplus and the ships, but until a way is found to send that surplus in our ships to foreign countries where it is so badly needed there is very little hope for much improvement in the purchasing power of our people at home.

Economy and the Naval Program

THE continued uncertainty of the status of the 1916 naval program and the piecemeal appropriations granted by Congress for the completion of this work show only too plainly why Government ownership or direction of industrial projects costs the taxpayers more money than it should. The arbitrary stoppage of work on our naval vessels not only places a severe load on the shipyards and the manufacturers of marine equipment by forcing them to carry their investments for an indefinite period without any

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financial relief but it also increases the individual cost of each ship.

It seems elementary and almost unnecessary to point out that the Government is making another record for extravagance in stopping this work, the greater part of which is well underway and getting along toward completion. Shipbuilding, whether on merchant or naval vessels, requires a large and highly trained personnel and to disrupt and then have to reorganize the forces in the shipyards and manufacturing plants engaged in this work is the most wasteful procedure possible.

Those of the civilian employees of the Navy Department who have been fortunate enough to be retained on a five-day week basis and the workmen in private organizations will find it difficult to keep up their interest and production standard in a work whose date of completion is scheduled as indefinite. They can hardly be blamed if they adopt the "ca camy" policy of making each individual job last as long as possible.

Economical production has been repeatedly advocated as the only means of the industrial salvation of the world, and the average American workman is capable of understanding the logic of this principle. But he also knows that when a private firm makes a contract it has to live up to it and he can hardly be expected, when work that Congress has authorized and the Navy Department has contracted for is suspended, to do his best.

This work will eventually have to be completed and now that England has authorized the construction of four new dreadnoughts there is no reason why the disarmament conference should be influenced by our completion of a 1916 project. On the other hand, the temporary stoppage of this work is fooling no one but it is hurting our marine industries and it will cost us much more money in the end.

Foreign Trade Policy Needed

THE greatest need of the present, both for the revival of normal trade conditions in this country and for the development of our merchant marine, is a foreign trade policy that will force into motion the unrestricted interchange of commodities between the stagnant markets of the world. The adoption, at this time, of adequate means to accomplish this purpose would do more toward restoring prosperity than those who are directing our destinies apparently realize; for it is estimated that over one-quarter of the production in the United States is surplus and must find a market which is other than domestic.

Granting that the United States must protect itself against unrestricted floods of certain classes of imports which are the result of cheap wages and depreciated exchanges, it is nevertheless true that the only practical way that the world can repay us or continue to take our exports is either by the means of their goods or their services. If our surplus cannot be marketed abroad because a high tariff restriction prevents the payment for it in the only feasible way, then we may look for a readjustment in our production that will be a great deal more harmful than any foreign competition that our industries might have to contend with.

A tariff that walls in our industries will delay the restoration of the world's markets and prevent us from enjoying the substantial rewards that would naturally come to us. The markets of the world can easily absorb our surplus in normal times. Reasonable foreign competition will have a wholesome effect on the cost of living and it will allow us as a nation, that is the best equipped for the purpose, to do our share in the reconstruction of the world and thereby hasten the payment of the vast debts that are owed us. We must have imports as well as exports or there will not be profitable employment for our merchant marine. Restricted imports and increased exports form an ill-adjusted trade relation that cannot continue for any length of time but a liberal foreign trade policy that will help other nations to prosper with us will solve the unemployment question, dispose of our extra products, find cargoes for our ships and reduce our taxation.

Trade Routes

THE niggardly appropriation that Congress has given the Shipping Board for the balance of the year and the failure to enforce the Jones Act have caused the tying up of an increasing number of Government ships. The Board should not be blamed for taking off these vessels for it cannot run them without money but Congress is forcing it to violate the law, which says that the Board is directed to "put into operation from the ports in the United States or any territory, district, or possession thereof to such world and domestic markets as in its judgment are desirable for the promotion, development, expansion and maintenance of the foreign and coastwise trade of the United States and an adequate postal service," such vessels as will meet these requirements. It further states that if the Board cannot sell or charter ships for these routes it shall operate them itself until the business is developed so that the ships may be sold and the service maintained.

It cannot be too strongly stated that the tying up of these vessels and the abandoning of trade routes are destroying what confidence is left in the American people in our merchant marine. Not only this, it is proclaiming our failure to the world and encouraging foreign monopolies to repeat what was done at Alexandria when the Liverpool lines said that not a pound of Egyptian cotton should go in American bottoms.

We have every reason to believe that Congress is very anxious to sell the Government fleet but, if it discourages the members of communities interested in new trade route developments who, as we see it, are the prospective purchasers of American maritime securities, who will take their place?

Can it be that Congress has such an unfortunate opinion of the value of our foreign trade that it would sanction the abandonment of direct trade routes forcing our goods to go via foreign countries? Does it actually contemplate by withholding appropriations to hand over to foreign competitors the business which has been built up and developed by American concerns? If such is the case there is bound to be an awakening when the American people realize what has been done to their merchant marine.

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Can a Shipping Subsidy Bill Pass Congress?

By Winthrop L. Marvin*

Whether discriminating duties or subsidies are the royal road to success for American shipping will be actively debated this coming winter, as in so many seasons past. Both have their merits; both their limitations. But it is exceedingly important that the questions presented by these two methods should be temperately discussed. They are not necessarily antagonistic or even alternative. We have tried both systems in our national life, and there are many Americans who think today that the best features of both may wisely be embodied in any supplementary legislation that may be essential to the complete outrounding of the Jones Merchant Marine Act of June, 1920.

THE most frequent objection urged to the subsidy plan is that "The American people will not stand for subsidies —Congress will never pass a subsidy law." All of which is simply an unconscious result of very persistent foreign propaganda. As a matter of fact, we have had subsidy laws in the United States sustained by an overwhelming majority of the nation. The first example was the Ocean Mail Law of 1847, enacted on the recommendation of a Democratic President, Mr. Polk. This earlier subsidy system gave the country its first transatlantic and South American steamship lines. That legislation proved as beneficial to steamship building and operation from American ports as the original discriminating duties and tonnage taxes had been to the sailing ships of the first half of the nineteenth century. As Dr. David A. Wells said of these pioneer steam lines:

"During the single year 1849-50 we increased our ocean steam tonnage one hundred and thirteen percent, and the seagoing qualities and performances of our vessels were so admirable that the Cunard Company, which had then been in operation ten years, was obliged to bring out new ships to compete with them. The prospect, therefore, at one time was that the United States, although late in the start in this new department of foreign shipping, would soon equal, if not overtake, her great commercial competitor."

When both America and Britain were subsidizing their mail lines, all the honors of the Atlantic went to the Stars and Stripes, floating over the larger, the more comfortable and the swifter ships, which commanded the bulk of the best cabin passenger traffic. Our ocean steam tonnage, which amounted in 1849 to only 20,870, had risen in 1855 to 115,045. It is a matter of history—how the sectional quarrel over slavery between North and South broke down the American subsidy system because of its rapid enhancement of the sea power of anti-slavery New England, New York and Pennsylvania. That is to say, our early subsidy experiment was abandoned because of its very success.

Postal Subsidy of 1891

Not again until 1891 was a general postal subsidy law placed on the statute books. It so happened that, though passed by a Republican Congress, this law was faithfully enforced by President Cleveland's Democratic Administration. It gave us the American Line of transatlantic steamers, still in existence, and it greatly strengthened our steamship services to the West Indies and Australia, even though the rates of compensation provided in the Act were cut down in the House of Representatives to what seemed to be an inadequate figure. The Ocean Mail Law of 1891 commanded the support of a majority of popular opinion, and remained on the statute books until set aside in part by the Merchant Marine Act of 1920.

Though shorn of its full, intended effect by sectional rancor in the National House, this Act stimulated ocean shipbuilding, developed strong shipping services and gave the country in the Spanish War of 1898 and in the great world war the invaluable nucleus of a naval reserve.

Between the Spanish War and the world war there were persistent efforts to liberalize and extend our subsidy legislation. These efforts failed. It will be interesting to review the facts in the case, because the actual records strongly support the assumption that the right kind of a subsidy law could readily be enacted by such a Congress as that now in power in Washington.

Frye Subsidy Bill

In the first session of the fifty-seventh Congress, in December, 1901, Senator William P. Frye, of Maine, chairman of the Committee on Commerce, introduced a comprehensive shipping subsidy bill providing national aid for regular mail lines and granting a fixed subsidy based upon mileage in the foreign trade for cargo steamers and sail vessels.

This measure involved an expenditure of about $9,000,000 a year. It was actively supported by all the shipping interests and a large part of the commercial interests of the country, and it passed the Senate by a decisive majority. But it encountered a hostile committee dominated by Middle Western men in the House of Representatives and could not be reported out of this Committee on Merchant Marine and Fisheries.

Gallinger Subsidy Bill

In the spring of 1904, on the recommendation of President Roosevelt, Congress passed a bill creating a Merchant Marine Commission of five Senators and five Representatives, a majority being Republicans. This commission, headed by the late Senator J. H. Gallinger of New Hampshire, conducted an active inquiry by hearings throughout the United States and reported a general shipping subsidy bill providing encouragement not only for mail lines but for cargo vessels, steam and sail. This measure passed the Senate on February 14, 1906, by a vote of 38 to 27.

As illustrating the increased popular strength of the subsidy principle when properly advocated and explained, the Gallinger bill, amended, however, so that bounties to cargo craft were stricken out, was passed in the House on March 1, 1907, by a vote of 157 to 145. Thus the measure, or a substantial part of it, had won a triumph in both branches of Congress. But the bill unfortunately met with filibustering opposition in the Senate, led by Senator Carmack of Tennessee, who was retiring from public life, and a few weeks later was slain in a street brawl in his home town. This defeat of the Gallinger bill was made possible by the fact that it was brought up in the last hours of an expiring Congress.

President Roosevelt, however, pushed the subsidy bill so vigorously that as an ocean mail measure it was again passed in the Senate on March 20, 1908, without a roll-call—the usual Democratic opposition being withdrawn, very largely out of respect to Senator Gallinger, after the passage of the measure had been earnestly advocated by several Democratic Senators. Three days later, in the House of Representa-

*Vice-President and General Manager, American Steamship Owners' Association.

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tives, on a motion to add the subsidy measure to the Post Office Appropriation bill, the vote was exceedingly close, but the motion was defeated 145 to 153. In the following session, on March 2, 1909, a renewed motion to pass the Subsidy bill as a part of the Post Office Appropriation bill was defeated again by the very narrow division of 172 to 175.

DEFEATED BY GERMAN INFLUENCE

What a difference a victory for the American ship would have made in those divisions in Congress! That Ocean Mail bill of President Roosevelt and Senator Gallinger would have rapidly constructed from thirty to forty large mail and passenger liners, of a speed of from 16 to 20 knots, capable of carrying from 50,000 to 100,000 fighting men in one voyage to the battlefields of France. These ships would have been of immeasurable value as additions to the skeleton naval reserve of the United States. But not even the magic influence of Roosevelt could win against the snaky German propaganda then active particularly in the half-Teutonized Northwest. Mark the States whose Republican votes on May 23, 1908, defeated this measure by the narrow margin of eight votes in the House of Representatives:

Wisconsin	8
Illinois	6
Minnesota	3
Iowa	4
Kansas	3
Nebraska	2

Here are exactly the States where the "German vote" in the United States is strongest, and where Representatives, all unconsciously, perhaps, but none the less effectively, were doing the Kaiser's will.

While these ocean mail-naval reserve bills were before the country, the heads of the great German steamship combinations, the Hamburg American Company and the North German Lloyd, were publishing broadcast in the American press all kinds of adroit protests and appeals against the passage of this American shipping legislation, which President Roosevelt had so strongly urged in fulfilment of the solemn pledges of the Republican platform. The men who chiefly inspired and circulated this propaganda against the American merchant marine were bold enough to do so over their own signatures. One was the late Herr Albert Ballin, the head of the Hamburg American Company of Hamburg; the other the late Emil Boas, agent of the Hamburg organization at New York. This alien opposition of Teuton magnates, who were looking forward to "The Day," was frankly denounced on February 26, 1907, by Chairman Grosvenor of the House Committee on Merchant Marine and Fisheries. General Grosvenor said:

"Two great foreign steamship companies which have bitterly fought the encouragement of American shipping are the Hamburg American Company of Hamburg and the North German Lloyd Company of Bremen, the latter subsidized for $1,350,000 a year for a 15-knot mail service to the East Indies and Australia.

"Both of the great steamship companies owe their wealth and their power largely to the patronage of American merchants and travelers. Yet in the crisis of our war with Spain, in 1898, both companies took fast ships out of the New York service and transferred them to the Spanish government."

General Grosvenor continued:

"The real head and front of opposition in this country to the encouragement of American shipping always has been, is and always will be the rich and powerful foreign steamship companies, most of them subsidized by their own governments. The foreign steamship companies that do not want this ocean mail bill—like the foreign shipowners who monopolize our trade—tell the Representatives of the Middle West that the West has no interest in an American merchant marine; that this bill is only 'graft' for the benefit of New England, New York and Pennsylvania, and that the Mississippi Valley and the prairie States ought to join with this foreign steamship 'combine' and with the subsidized companies of foreign countries to defeat in this House all legislation for the protection and encouragement of the American merchant marine."

At that very time German propaganda was recognized and denounced by the friends of the American ship in Congress. To their credit, be it said, a decisive majority of the Republican Representatives of the Middle West, as a whole, voted for the subsidy measures and for the upbuilding of our merchant marine. But the minority of these Middle Western men, significantly in States like Wisconsin, voted with the almost solid Democratic party, opposed in principle to subsidy, against the measures which Senator Gallinger had framed and President Roosevelt was supporting. In fact, several years later, such was the infatuation or cowardice of these Middle Western public men, that many of the most conspicuous foes of the subsidy bill voted against the declaration of war with Germany!

This Teuton propaganda at the height of its power in Congress was able to defeat subsidy legislation by eight votes out of a total of 298 on May 23, 1908, and by only three votes out of a total of 347 on March 2, 1909. Does anybody imagine that the German propagandists have any such grip now as they had then on Middle Western Republican Representatives from Teutonic districts? Does anybody imagine that the Middle West as a whole has learned no lessons from the great world war of the vital importance of an American merchant marine?

SUBSIDY BILLS DEFEATED BY SLENDER MARGINS

On the face of the record it ought easily to be possible for President Harding and his unprecedented Republican majorities in the National House to pass subsidy legislation carefully drawn, vigorous and comprehensive. It is easy to say that subsidy bills were always defeated. As a matter of fact, they were not always defeated, and when they did fail it was by the slenderest of margins. Senator Gallinger—all honor to his memory—could not beat the German propaganda of his time. But he almost beat it, though it was so bold and unblushing that a distinguished Senator from the State of Wisconsin, after attacking with the utmost bitterness the Merchant Marine Commission bill in the Senate, saw nothing wrong in resigning from the Senate and going over to New York to become the general counsel of the Hamburg American Steamship Company, which naturally appreciated such services.

The Germans of the Northwest now have no particular motive to oppose the passage of American shipping bills, for the ships of the Fatherland are few and far between, and it is Great Britain that is our principal antagonist. Moreover, the great war has had its effect upon the Democratic party, which probably could no longer be depended on to oppose subsidy as a whole. It should be said for the Democrats of 1906-1909 that they voted against the subsidy legislation because for a generation they had been in the party habit of voting against it, and not because of the effect of any foreign propaganda or any lack of zeal for the American merchant marine. But the Northwestern Republicans who voted against their party and against their President could proffer no excuse—for these very men were zealous enough to vote the very next day for tariff favors for their agricultural constituents. It happened that I had been serving as the executive officer of the Gallinger Commission at that time, and one of those Northwestern Republicans, a native of New England, actually confessed to me that he had to vote against the shipping bill or the German element at home would defeat his reelection.

Because I know of very direct knowledge what defeated that shipping subsidy legislation, I cannot agree that in these times "no subsidy bill can pass."

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The Ship Operator's Interest in Foreign Trade

Our Merchant Marine Should Carry at Least 50 Percent of the Products of American Factories and Farms to Markets of the World

By John L. Binda*

IN those halcyon days for the American merchant marine when our clipper ships were known and seen in all ports of the world and when our merchants made fortunes, which were the foundations for many of the large fortunes of today, by trading in everything that could be exported or imported, the ownership of the vessels and their cargoes was largely a local matter pertaining to those living in the immediate neighborhood of where the ship was built. The merchants, traders, manufacturers and farmers were all investors, while the master and crew shared in the resultant profits.

Interest in overseas commerce was then universal and the ship operator not only occupied himself with the routing of his ship but was also interested in the disposition of the cargo. He often possessed a profound and intimate knowledge of the markets of the world and the economic conditions prevailing therein. Moreover, he understood and appreciated the great element of national service in foreign trade.

In these days of specialization and standardization, however, the operator of ships seem to have restricted his interest to the immediate management of the vessels in his possession. He is neither concerned with the origin of his cargo, nor with its ultimate disposal after delivery to the ports of call. Furthermore he does not realize that every branch of business in the country is dependent more or less upon and tied up in some degree with shipping.

In the United States we have reached the period of industrial development where foreign trade has become distinctly and incontestably a matter of national service. We can no longer afford to depend, as we have depended chiefly for so many years, upon foreign trade merely as an opportunity for the casual disposal of temporary surplus. Our industrial development which has progressed so steadily and rapidly during the last half century reached its climax in the war period. We have attained the degree of production where we must either sell largely and continuously abroad, or endure stagnation and disaster at home.

Commercial Opportunities

The commercial benefits of trade and of that understanding between nations which leads to the mutual exchange of products, which protects merchants and merchandise and gives to the trader of other countries, under more or less easy conditions, opportunities for commerce with this country, are very vague to him.

If we were to consider foreign trade in all its aspects, it would involve consideration of every phase of our existence. It is closely interwoven with our politics, our finance, our industry and commerce, our railroads and shipping. It influences and is influenced by every one of our human activities. Foreign trade is the concrete expression not only of our exchange of goods, but to a great extent of our intellectual, personal and institutional relations with other people.

Foreign trade is a study and a science in itself. It is a business founded on principles and determined by conditions that require constant study and attention. It was the knowledge of these facts, and the conformity thereto, that has made Great Britain the great foreign trading nation of the world.

Domestic Market Not Sufficient

The present wave of industrial depression has clearly shown how fortuitous and casual our foreign trade has been in the past. We built a great merchant marine in a few years to carry the product of American factories and farms to the markets of the world. There was a time not far back when the demand from abroad strained the capacity of the mills, the factories and the farms. The stars and stripes were again becoming familiar in every port. The long hoped for day when at least 50 percent of our foreign trade would be carried in American ships was in view.

But what a change has taken place! With the stagnation of shipping, resulting from the worldwide business depression, our merchant marine has been forced gradually to withdraw from the seas. At last the ship operator is beginning to appreciate the vital necessity for the continuous and proper development of our foreign trade.

At present we are confronted by a situation of exceptional difficulty and though we may not possess the benefit of world-wide long experience of some of our competitors, a proper appreciation of the meaning of foreign trade to the nation and a spread of sympathetic understanding among our people as to the necessity of doing all in their power to assist in its development will brighten prospects for an early amelioration of the present conditions.

Debts Must be Paid by Imports

The liquidation of the tremendous amount of foreign securities held by the Government and investors should be of vital concern to the ship operator. The war turned us from a debtor to the world's greatest creditor nation, and instead of having an interest outgo of $250,000,000 per year, we are entitled, when Europe gets back into condition to produce and pay, to an interest income of nearly $600,000,000 per year. In theory this interest must be paid in money. In practice, however, the debtor countries will pay in goods, materials or in articles which our climate will not allow to be produced or not to be produced in so useful a form.

When a country borrows, it exports securities and takes goods in exchange. In theory the lender provides money; in practice he lends manufactures, rails, rolling stock, ammunitions, supplies, etc. In the early development of the railroads in the United States, the financing was done in England and it was British steel that was used in the construction. During the world war the loans to the Allied countries, although expressed in dollars, actually represented war material and food bought in this country and shipped abroad.

The ship operator will, therefore, realize that there will be for sometime to come an ever increasing flow-back into this country of articles of European manufacture. The importation of these goods instead of money and securities will cause a check of the tendency to increase the amount of currency in this country and lower the value of the dollar. Another result will be that while we can sell abroad goods that we can

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produce to a better advantage, this will be counterbalanced by the importation of other goods which can be produced better abroad.

Imports We Must Have

It is because we have great need of certain materials that can only be satisfied outside our country, that foreign trade is a necessity. Little does the manufacturer of this country realize how dependent he may already be upon foreign countries for the supplies that keep his industry alive. If he is a leather manufacturer, he must import quebracho for tanning from Argentina. If he manufactures anything in which the use of rubber enters, he must see that his business would be impossible but for the importation of rubber from the Straits Settlements and Brazil. Does he manufacture tin plate? Then he must go to Bolivia for his tin. No flax, jute, or sisal—all of which are so important to many of the industries of the United States—is grown in this country and our supply must be obtained from other lands. This list might be extended indefinitely, but it is sufficient to show that in practically every article manufactured in the United States there enters a product of some foreign country, and that, after all, we are as dependent upon foreign markets as upon local markets for the proper development and continuation of even our domestic business.

There is nothing "foreign" about foreign trade, for it is based upon the same principles and is simply an extension of domestic business to which new languages, new points of view, new business methods and new ways of doing things may be added.

No nation can flourish, if the individuals comprising it are not actively employed in profitable occupation, the measure of that profit being the manner of the general weal. A country dependent solely upon the proceeds of the cultivation of a poor soil in an uncongenial climate and the scanty returns of occasional fishing and hunting is fated to remain low down in the scale of civilization and its people are unable to enjoy those advantages of culture, education and refinement common in other lands more richly endowed. It is because this country enjoys fertile soil and a variety of climate and is richly stored with coal, iron and other natural resources that its inhabitants are able to partake of greater advantages than are the inhabitants of the Old World.

Market Price Determined by Surplus

Interest in foreign trade in this country did not extend, prior to the war, much beyond such of our citizens as inhabited a narrow fringe along the Atlantic and Pacific seaboards. It has been hard for the farmer in the interior to realize that the price received for his cereal is largely the price which the surplus portion of his crop obtains in the final consuming market of the world, less expense of transport and sale; that such a price governs not only that exportable surplus but fixes the level at which the domestic portion of his production sells at home.

The necessity for a sympathetic understanding by the ship operator of the problems which confront the farmer in the economic disposition of his produce to the markets of the world is vital. Every step which reduces the expense of transportation also tends to increase the net return on the entire production of his farm. The consuming countries of Europe largely make the measure of the prosperity of our cereal producing regions. Complete and adequate ocean transport, with regular service and fair rates, will directly reflect into the maintenance of the buying power of our farmers.

I think that it was Sir Walter Raleigh who said that the nation which controlled the shipping of the world controlled its trade and in that way the world itself. This may not be entirely true, but it cannot be denied that the control of ocean transportation has been a determining factor in the economic life of a country possessing it.

For many years the transportation of the products of our factories and farms to the overseas markets and the buying back of valuable raw material used in our manufactures has been in the hands of the merchant marine of the European nations with Great Britain as the dominating factor. In 1914 our total tonnage in foreign trade was less than two and one-half percent of the world's shipping. The five billion dollars which we owed to Europe at the outbreak of the war was largely resultant from our lack of foresight in not having developed an adequate merchant marine.

Subsidy Has Gone to Foreign Ships

Owning few ships we have been obliged to pay to the foreign ship operator nearly twenty cents on the dollar in freights to send our goods to the foreign markets and another twenty cents had to be added onto the cost of everything bought abroad for transportation to this country. This added handicap has made it comparatively difficult for us to compete on an equal basis in foreign markets with our greatest competitor, which has had the advantage of being able to add to the national income of her subjects twenty cents on every dollar received for the transportation of the commodities entering into our international trade.

We are now in possession of a merchant fleet sufficient for the needs of our international commerce and there is no reason why the ship operator should not be able to retain in the United States a great proportion of the tremendous amount annually paid foreign shipowners for transportation. To do this he must have an intimate knowledge of the fundamental principles involved in foreign trade. He must become aware of the many benefits which its steadfast maintenance brings not only to himself but to every man, woman or child engaged in a productive capacity, for the wide outlets of world trade serve to maintain a steady flow of output, which in turn stabilizes the job of the worker.

Diesel-Electric Yacht Guinevere Successfully Completes Her Trials

EDGAR PALMER'S yacht *Guinevere*, which has just been completed at the yards of George Lawley & Son, Neponset, Mass., successfully passed her trials on August 15. Designed by A. Loring Swasey, the *Guinevere* is a three-masted schooner with a waterline length of 165 feet, overall length of 195 feet, beam of 33 feet and displacement of 642 tons. Her chief feature of interest is, however, her auxiliary power, which is of the Diesel-electric type.

Her power plant consists of two six-cylinder, 350 horsepower, model 24-A Winton oil engines of 225 revolutions per minute, each of which is directly connected to a 225 kilowatt, 125 volt Westinghouse direct-current generator. Power from these generators is supplied to the Westinghouse propeller motor, which develops 550 horsepower at 250 volts and 220 revolutions per minute.

On her trials the *Guinevere* ran over the 6¼ nautical mile measured course between Boston Light and the lightship, attaining a speed of 11.82 knots, which is a knot more than contract speed. At no time did the propeller speed exceed 180 revolutions per minute, and since the propeller motor is capable of 220 revolutions per minute the *Guinevere* has plenty of excess speed.

Special tests made to determine the ability of the vessel to reverse gave the following results: Time to reverse the propeller motor from full speed ahead, 3 seconds; time to effect astern movement of vessel from full speed ahead, 25 seconds; time to effect ahead movement from full speed astern, 15 seconds. During these very severe tests, the motor and generator showed no sparking or signs of overloading.

The reliability of the electrical equipment and the high speed obtained, as shown by these tests, emphasize the practicability of Diesel-electric drive for commercial service.

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The Shipping Board Gets Its Chance

By Waldon Fawcett

The 'new management" at the United States Shipping Board has been given until January 1, 1922, to work out its own salvation—to show what it can do to bring order out of chaos. It must accomplish its rehabilitation (if it can) on a "deficiency appropriation" for the last half of 1921 that is much below the estimates submitted to the Congressional committees on appropriations. But in voting an operating fund of $48,500,000 Congress showed a disposition to allow Chairman Albert D. Lasker, the new head of the Shipping Board, to make a test of his policy without imposing undue limitations or restrictions.

NOTWITHSTANDING the conditions at the Shipping Board revealed to Congress in the past few weeks, Chairman Lasker has disavowed any intention to discourage the Government and the national legislature with respect to its merchant marine. On the contrary, he has insisted that some one must show confidence in the American marine, if it is to triumph, and that some one can only be Congress. The Shipping Board fleet, in the time it was operated, "saved to America untold millions of dollars in freights that would have gone to other countries," according to the retrospect of Chairman Lasker, and in the years to come the United States must have an adequate merchant marine or it might as well put an end to its army and navy. It will, he prophesied, require a year "to show anything" and two years to show any efficiency in the rehabilitation of the government-owned merchant fleet but, if every element in the nation is helpful, "the wreck can be turned into an asset so great that from a money value it will be worth the whole $26,000,000,000 that the war cost us."

System of Operating Ships to Be Revised

In shipping circles, interest in the new program of the reorganized Shipping Board will focus most sharply upon the revision of the system of ship operation. And it is here, as it happens, that the manifestation of readjustment has been most radical and most immediate. In effect this involves a divorcing of the detail of operations from the direct responsibilities of the Shipping Board. When the new executives took charge they were appalled by the system which referred every administrative detail of ship operation to headquarters. At one of the early meetings the Shipping Board expended four hours in discussion of one little detail that, as the members afterward confessed, would, in any minor business, be left to a subordinate.

Such a system, it is now felt, shows a faulty perspective on the responsibilities that the law assigns to the Shipping Board. The main function of the Shipping Board and the permanent function, if the Shipping Board is to continue in existence, is to exercise certain regulatory functions over American ships and over all ships touching at American ports, very much as the Interstate Commerce Commission exercises supervision over the railroads and railroad traffic of the country. To this primary duty was added, as the occasion of war required, the operation of the merchant vessels owned by the Government. The result of a literal application of this latter obligation is that whenever a vessel was to be reallocated or when a change of registry was in contemplation the detail was laid before the chief executives. There was neither time nor energy left for the proper consideration of broad questions of policy.

Shipping Board to Shape the Policies

To bring emancipation from this burden of detail is the object of the current change in policy which places the operation of the vessels under the Emergency Fleet Corporation. The members of the Shipping Board are the trustees of the Fleet Corporation and thus they are in a position to exercise the full supervisory powers with which they are vested by law. Yet there will be that decentralization of authority, the lack of which in the past has resulted in that tardiness of decision which passed for incapacity and which when it impeded the announcement of rates on cargo resulted in losses estimated in the aggregate at millions of dollars.

The backbone of the new system of ship operation is found in a trio of new executive positions whose occupants are answerable directly to the Shipping Board. Operating vice-presidents, they are designated, these new managing directors in charge of operations. These vice-presidents, all men of wide practical experience in the shipping field, carry out the policies formulated by the members of the Shipping Board, acting as trustees, and they are of course answerable to the trustees. The operating vice-presidents have plenary powers—the first time that there has been any such delegation of authority under the organization of the Shipping Board.

Actual Operating Plans in Experienced Hands

Determination to bring about operating conditions that would compare favorably with the corresponding status in the sphere of private shipping was indicated by Chairman Lasker's initial selections for the vice-presidential berths. The appointees, W. J. Love, E. J. Frey and J. B. Smull, were selected after a careful canvass of all the executives in the shipping business who might fittingly be drafted for such service. Mr. Frey was for years assistant to the president of the Pacific Mail Steamship Company but he was associated with the Shipping Board all through the war. W. J. Love, eulogized as "one of the few American managers, American born," was formerly with the British shipping firm of Furness, Withy & Company. J. B. Smull is a member of the ship brokerage firm of Winchester & Company. Messrs. Smull and Love were members of the charter committee of the United States Government during the war and thus obtained unique experience through the allocation of all vessels under the American flag used for merchant marine purposes during the war. This trio of experts on allocation and charter are bringing to bear their combined judgment and experience to draft a successor to the M O 4 charter, or contract—a new form that will result automatically, so to speak, in the filing of a report on every voyage.

Just here, it should be noted that managing operator's contract No. 5, supposing it to be distinguished in that manner from the four preceding contracts or agreements, does not presume to wipe the slate clean and start anew the entire program of ship operation. Chairman Lasker has stated that unsatisfactory as is the five-percent-gross-revenue system it is not proposed to scrap it ruthlessly until there is something better to substitute. Moreover, the present condition of the shipping business—the reported impossibility

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of making bare boat charters, etc.—has convinced the new head of the Shipping Board that this is not a time to revolutionize the operating system at one stroke.

Warning, he gives, though, that the minute world trade revives so that vessels may be operated at a profit it is the intention of the Fleet Corporation to compel interests that have continued to operate under the M O 4 contract to either purchase the ships in their possession or else enter into new contracts on a basis more favorable to the Government. Otherwise the vessels will be transferred to other operators who will buy or will make charter on a basis deemed to be more equitable to the Government. But the new administration is determined to put an end forthwith to practices on the part of operators such as the routing of ships without regard to the interests of the Government, so long as a profitable commission be assured to the operator, and "side line" enterprises, such as the organization by ship operators of stevedore companies, the excessive charges of which are approved by the interested ship operators.

Ship Repair Accounts to Be Kept Up to Date

A reform is also slated at the Shipping Board in the auditing of repair accounts, the delays in the past being charged largely to managing operators. By former practice it was the custom of the repair companies to submit their bills to the vessel operators for approval. In many instances, the operators did not pass the bills along to the auditing department of the Shipping Board for weeks or months. The auditing is just beginning to get up to date on repair accounts and in the payment of back bills. During the past few months appreciable progress has been made in this direction and it is believed that with the revised routine, which no longer requires the submission of the bills to the managing operators, it will be possible to keep matters up to date.

Director of Operations J. B. Smull took up his new duties in Washington convinced that it was necessary to change entirely the method of operating boats. In this he held to the idea that ultimately all the vessels should be sold. The Shipping Board or the Government should, just as soon as possible, get out of the business of vessel ownership. But there is no present possibility of selling boats at any price and while awaiting a sale market a new form of charter, which will probably be of the bare boat type, is being worked out by the Shipping Board. A committee of the American Steamship Owners' Association will also draw up a form of charter acceptable to the shipowners for the guidance of the Board.

Director Smull's Recommendation

It is conceded that the present is not an opportune time for bare boat charter or sale but, if it is impossible to persuade enough operators to co-operate with the Shipping Board and take some of the risk of operating, the director of operations will recommend that the boats be tied up until such time as it is possible to allocate them upon a basis more favorable to the Government. This will be the recommendation, even though it might increase the immediate loss to the Government to tie up the boats. Director Smull was willing to go further and recommend cancellation forthwith of the contracts in force and the substitution of some sort of co-operative plan. Chairman Lasker concurs with his associate in the feeling that, even though it costs more to tie up the loss-taking vessels than to operate them, this course should be pursued for its effect upon the operators. He feels that, if operators find that they cannot have vessels under the ultra favorable terms that have prevailed in the past, they will negotiate with the Shipping Board on terms less one-sided. All the while, however, Chairman Lasker insists that the 5-percent-gross-revenue contract is really detrimental to the best interests of the ship operating class as well as to the Government. Nobody has any pride in the boats, he declares, and insists that a merchant marine can never be built up in the way the nation has been going. "The old contract system," insists the chairman, "is the worst thing that could happen to the shipowners of America. It does not create stability and it would mean more to the shipowners than it would to the Government to change that system."

Firm is the faith of Director Smull that under a different plan of operation between the Shipping Board and the ship operator the operator will eventually own his boat outright. Especially is the new director confident that co-operation of this kind would be the means of developing profitable new trade routes. Discussing this aspect of the matter the other day, he said: "There are routes that can be developed that Americans have never touched at all. Their scope of business has been too small to allow them to do it.

American Steamship Operators Widening Their Field

"They have been brought up in the Western Hemisphere business or in running to South America or along the coast and they have never broadened. The American steamship man before the war was a rather narrow-gaged man who just ran in the route his father ran before him, or that his grandfather ran before him; but the war came along and it has developed in the American steamship operator the desire for world trading and he is going into it. You have seen in the last two years, or since the war has been over, that these men are spreading out in all directions. The routes that they have not tackled are the routes that they are afraid to tackle and I think it will be advisable for the Shipping Board to help them."

It is admitted that it will take some time to work out a satisfactory operating system and it may be that there will needs be several plans, or modifications of the standard plan, in order to afford suitable conditions for the various classes of ships. Director Smull is set, however, on some plan whereby the operator will accept some of the responsibility for the losses as well as for the profits. He argues that a ship operator should have something at stake so that he will be vitally interested in the operation of the boats; so that, as the director illustrated it, the shipping man will be vitally interested in the question of whether it costs $30 or $50 for a tug to take the boat out of the pier.

One of the ambitions of the new management at the Shipping Board is to do its full share to make vessel operation profitable. All routes are to be carefully inventoried in a determination to ascertain if any routes are over-tonnaged and to cut down the allotments of vessels so that the ships on each route will pay, or at least that losses on parallel lines will be avoided. The new administration will, in the case of all M O 4 contracts that may be continued, overhaul the system of purchasing food and rations that have been in force in the past. Commenting on the record of the past and expressing hope for the future, Director of Operations Smull recently remarked that the fiasco was not, perhaps, the fault of anybody in particular so much as it was the fault of a system. "Practical men must be put in charge" is his slogan for the forward march and it means that not only will practical men sit at the desks at Washington but that each "branch office" where contact is established with the shipping community will be in charge of an executive who has had shipping training and experience.

Electric Lanterns for Oil Ships.—The Standard Oil Company has recently installed in the pump rooms of their oil ships, several hundred LaFrance fire and explosive-proof electric lanterns, manufactured by the American-LaFrance Fire Engine Company. The adoption of this lantern was considered advisable due to the inflammable nature of the air where they are to be used. A new front arrangement, makes possible quick change or replacement of the glass lens or the lamp bulb without using a screw driver or other tools.

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Developments in Marine Insurance

Insurance Certificates—Insurance Rates—Theft and Pilferage — Load Line — Bunker Fires

By "Bordereaux"

THERE is a rueful truism current among marine insurance men to the effect that their business is the first to feel the pinch of hard times and the last to recover from it. By which they mean that when trade slackens insurance immediately begins to wane and only feels the touch of revival after productive industry has had its hour's head-start and the underwriter is finally called in to guarantee safe passage for the output. The present period of slump and reconstruction is, therefore, being accepted with grim philosophy; and the underwriter has need of all the constancy he can command.

Not in many a long year has marine coverage been so little in demand, nor have many men now in the business known a time when losses were heavier or the moral hazard more formidable. Ask them "How is business?" and you will be answered: "There ain't no such animile." Barring a hull here and there and an occasional bulk or general cargo, there is little enough to insure. The point is that these are the kind of times that put underwriters to the acid test.

The solid, established offices will know how to weather the storm but the newcomers are flying distress flags. These latter were attracted to the business by the tremendous profits derived from covering war risks. For a time they did a land-office business and piled up fortunes almost over night, but with the return of normalcy they were dismayed to find themselves suddenly bereft of exorbitant revenues and now, with nothing but cold, straight marine insurance to fall back upon —and but little of that—their inexperience has small chance in a contest with the skilled veterans. Many of them have already given up the struggle and more of them are bound to do so.

The effects of this ill-starred invasion of so intricate a line of work have been disconcerting even to the old-timers. The market has been disrupted by desperate efforts to recoup through suicidal rate cutting and the concession of unprofitable coverage conditions. Claims have been side-stepped by the novices whenever and wherever they could manage it. And, to make a bad situation worse, foreign reinsurers have frequently left them in the lurch. However, the worst is well over and the market is shaking itself into shape.

Marine Insurance Certificates

PERHAPS the most disconcerting occurrence of the year has been the decision by Justice McCardle, of the King's Bench Division of the English High Court of Justice, to the effect that a marine insurance certificate is not the same thing as the original policy and may not be substituted for it. This dictum, if given wide acceptance, would strike a mortal blow at the most convenient and labor-saving device now employed in this business.

The certificate applies only to cargo shipments. It originated in this country and has been in highly satisfactory use for more than a half century. Foreign insurance companies domiciled here make free use of it and a number of foreign countries have adopted it. In this country at least it has largely replaced the insurance policy itself as the document used in financing commercial transactions. The general practice now is for merchants to take out open policies for the protection of all their shipments over certain described routes and under such policies the assured is given the privilege of issuing certificates on special forms.

These certificates, when properly countersigned by some authorized representative of the company, afford a convenient way of issuing negotiable evidences of the insurance itself. They have always been acceptable to the banks and make one of the four documents which collectively are known as a "commercial set"—namely, the invoice, the bill of lading, the draft or bill of exchange and the insurance certificate. They provide for payment in all parts of the commercial world and, when issued by responsible underwriters, are accepted at their face value in every banking center everywhere. This insures additional promptness in the payment of claims, as foreign settling offices are under no necessity of forwarding documents to the original issuing company.

The point made by Justice McCardle is that the buyer can not know that the certificate is of proper character unless he examines the original policy and that he could not sue under it unless he showed that he is the assignee—which is something, in his opinion, unprovided for under the Marine Insurance Act of 1906, the controlling law of England with respect to marine insurance. This decision, it must be admitted, shook the American marine insurance market up considerably, but sober second thought has restored its equanimity. Much of the force of the Justice's contentions is lost by the fact that the very certificate in question is found to have contained all clauses necessary to inform its holder of the conditions of the insurance on the particular shipment which it covered. The real reason that England does not herself employ certificates is because her laws require the imposition of a stamp tax within ten days of the arrival of a shipment in her ports; this tax has to go on the original policy. No reputable American underwriter has ever repudiated its certificates, whether they carried the British stamp tax or not. England has no open policies, but it has what is practically the same thing, a "perpetual cover."

The American Institute of Marine Underwriters has had the McCardle decision under consideration, but it is improbable that any especial action will be taken. The whole matter, it is confidently believed, will soon blow over.

Insurance Rates

THERE has been a deplorable tendency on the part of American shipowners to bring all the influence they can control to bear upon a reduction in insurance rates. Only last June the managers of the American Marine Insurance Syndicates granted a reduction of from 15 to 20 percent on all Syndicate "B" boats, and they feel that they can go no further without inviting certain loss to the subscribing companies.

The reason for unrest on this point on the part of our shipowners is the wide-open condition of the London hull market. When the British Hull Agreement collapsed, two or three months ago, it threw rates, values and conditions into a welter of chaos and Lloyds and many of the more greedy company underwriters flew at one anothers' throats in a mad scramble for business at any old price. The natural result has depressed insurance rates to a losing basis—but it has presented shipping interests with the greatest bonanza they ever had over there.

The effect of this was at once felt by shipowners on this side and that is why they would like to see something of the same sort in vogue here. It would bring their insurance

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overhead nearer a competitive equality with that of their foreign rivals. But fortunately for the stability of American marine insurance the majority of the board of managers of the Syndicates have set their faces firmly against any such suicidal recourse as a rate war with their desperate British competitors.

Bunker Fires

BUNKER fires continue to cause a consistent run of losses. Underwriters urge close attention to the problem of proper care for the stowage and watching of bunker coal, as they have been compelled to charge this hazard with a very considerable increase in marine casualties. It is found that certain varieties of new coal, much of which is untested, have been employed to fill out shortages caused by the recent British coal strike and that spontaneous combustion has frequently developed in them. Excessive heat, so generated, extends to coal in permanent reserve bunkers and releases gases which readily become ignited. The chief causes of bunker fires lie with the regrettable tendency to slight the cleaning out of bunker waste, which accumulates in the form of coal dust and forms dangerous pockets.

Theft and Pilferage

OF all the alarming consequences of the late world war the most serious to marine insurance has been the enormous increase of theft, pilferage and short delivery claims. This has come about through an undermining of moral fiber and a disregard for property rights, combined with a suspension of discipline among transportation workmen, whose services were so all-important during hostilities, and a subtle change in the relations of shipowners, shippers and underwriters.

The risks of theft and pilferage, which may be described as the stealing by stealth of goods while in the custody of third parties during the process of transportation, are not covered by a marine insurance policy unless provision therefore is made by special endorsement. They are not properly marine perils and the underwriters should not insure them at all. They drifted into doing so during the war as an accommodation to their patrons. Prior to that the burden of this hazard had rested upon the steamship companies; but under stress of war conditions the latter became virtual dictators in overseas commerce and shifted the responsibility to the shoulders of the underwriters by introducing clauses in their bills of lading which negatived in large measure their common law liability for property in their custody.

This led to a relaxing of vigilance in the safeguarding of shipments and the evil grew by leaps and bounds. It has extended to every part of the world. Underwriting offices have been swamped under an endless deluge of claims and the situation is as bad today as at any time since the war. Better packing has been effected and advertising matter removed from shipping cases—thus doing away with two fatal avenues of criminal approach—and shipping marks have been regularly changed to mystify the thieves; still the losses continue to mount up. Remedial devices, in the shape of new policy clauses, have been tried without success both here and abroad.

So great has become this menace that the attention of the national Government has been called to it, and the House committee on the Merchant Marine and Fisheries has under consideration the advisableness of amending the Harter Act so as to restore to it the force originally intended by its framers and place responsibility for goods in transit upon the shoulders of the carriers. This movement is receiving the unanimous support of marine underwriters. They contend that the original Act has been made largely non-operative through numerous amendments, State statutes and court decisions and that, in consequence, carriers are today able to limit their liability to negligible amounts. The weakness of the Act is that it limits the scope of the carriers' liability, but not the amount of it. The old Act of March 3, 1851, on which rests the principle of American maritime limitations, imposed a much more strict account. The Harter Act, which was passed February 13, 1893, fixed no new obligations upon the shipowner, but, on the contrary, accorded him exemptions he had never had before. A leading authority in admiralty law has pronounced it "the great bulwark of the foreign shipowner—in fact, of all shipowners—in contesting liability for cargo losses."

Load Line

THE reconvening of Congress brings up for final decision the question of America's having a load line. Marine underwriters are solidly behind the affirmative. They argue that the United States stands practically alone among the great Powers in being without this safeguard to marine life and property, and that there can be no valid contention against it that is not grounded upon selfishness. They insist that their advocacy of the proposal does not arise from selfishness, as they would only have to raise the premium rate to equalize adverse conditions; but they feel that America, without a load line, is in a disadvantageous position with respect to other nations—having no reciprocal demands to impose—and that the lives of American seamen are imperiled for want of it. Leaving the loading of a vessel to the discretion of a master or captain is regarded by them as a hit-or-miss method of less than doubtful value. Furthermore, a scientifically ascertained and imposed line puts the conscientious and careful shipowner on a competitive equality with his less scrupulous competitor, who, with an identical overhead, may now out-operate the former by carrying more cargo.

Under the provisions of the proposed bill the determination of our load line would rest with the Secretary of Commerce, and a commission appointed by him has reported a line that has an advantage over the British Plimsoll marks in that it is made from the viewpoint of America and American trade. Underwriters predict that such a line would result in the lowering of the insurance rate, because the loss on boats would probably be less. They also feel that our national position would be immeasurably enhanced, if we have a definite plan of this kind in operation, when we enter the international load line conference that is certain to be held in the not remote future. We could then enter such a conference with a worked-out, well-working plan of action, rather than have to accept and make the best of some foreign proposal specially adapted to the needs of other interests and conditions than ours.

Rates via the St. Lawrence

QUESTIONS are frequently raised as to the probable effect upon marine insurance rates of the carrying through of the project for the St. Lawrence inland waterway, particularly as it would concern an all-water route from Duluth via Montreal to the United Kingdom. A comparison of rates as at present obtaining on, for example, grain shipped from Duluth all-water to Montreal and thence to the United Kingdom, with the same commodity shipped over the lakes to Buffalo and thence by barge canal to New York for transshipment to the United Kingdom shows a differential during the summer months of about 10 percent in favor of the latter route, with a rapidly increasing differential in favor of the New York route from October 15 to the close of navigation out of the St. Lawrence. The summer differential might be practically wiped out, if there were a direct all-water route via Montreal eliminating the transshipment which now occurs at Port Colborne or Kingston.

The present basic transatlantic rate out of Montreal is practically double that of New York; this is because Mon-

(*Continued on page* 778.)

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Marine Exposition a Combined Maritime Gathering

National Marine League Unites with Society of Naval Architects and Marine Engineers and Marine Equipment Association, Navy Department and Shipping Board to Exhibit and Co-operate

CONSIDERABLE progress has been made by the Marine Equipment Association of America in its plans for "American Marine Week"—November 14-19; and everything points toward this as the greatest single event of its kind in the history of marine shows.

At a meeting of the Executive Committee of the Association on September 19, a number of matters were decided, the one of first importance being the unanimous acceptance of a proposal for complete co-operation with the National Marine League submitted by its president, P. H. W. Ross, in person at the meeting. In substance, the agreement provides ways and means for uniting the efforts of the two organizations in the matter of stimulating public interest in a real American merchant marine.

Chairman Wampler of the Exhibit Committee reported that notwithstanding no concerted effort has as yet been made to sell exhibit space, applications had been received from a number of concerns aggregating something like one-third of the total number of square feet available and that the outlook was decidedly favorable.

Registration and Badges

The question of badges for members and guests who attend the exhibition was then brought up. A design was approved; and it was decided to provide distinctive colors for members, guests and ladies. In an effort to expedite the work of registration, an advance canvass will be made among the members of the Society of Naval Architects and Marine Engineers, American Society of Marine Draftsmen and other like organizations in an effort to learn who will either attend the annual conventions of their respective associations or be in New York during "American Marine Week." Further, beginning on the morning of the second day of the exhibition (November 15) printed lists will be distributed each day, containing the names, badge numbers, occupations and New York City addresses, if any, of all those to whom badges had been issued up to closing hour on the night previous. All names will appear, both alphabetically and numerically, so that one can tell at a glance whether a certain person is registered as attending the show, and be able to identify him at sight by his badge number if unknown to the user of the list. While the idea is not new, printed lists of that kind having been used continuously at conventions in the steam railway field for some twenty years, this is the first instance where any like attempt has been made in the marine field. Not only are lists of the kind valuable as permanent attendance records, but when used on the ground in connection with the numbered badges, they contribute much in bringing together those who design, build, repair and operate ships and those who manufacture and sell.

Owing to the absence of the treasurer of the association on vacation and the necessity for having a disbursing officer located in New York City, H. C. Davis, of Row & Davis, Engineers, Inc., was appointed acting treasurer.

The businesslike way in which the Marine Equipment Association is operating is reflected in a series of nine bulletins which have been mailed to all prospective exhibitors. No. 1 gives full information about membership dues, rates for space and payments therefor and a lot of detailed information about exhibits and their limitations, to which are attached a floor plan and an application for space. Bulletins 2, 4, 5, 6, 7 and 9 cover various subjects of interest to exhibitors, including very complete information about shipping and setting up exhibits; while Bulletins 3 and 8 contain advertising suggestions and information about free admission tickets. The information given is so complete as to leave little room for imagination and thus the necessity for questions by prospective exhibitors is reduced to a minimum.

All Marine Associations Invited

It was decided to issue invitations to attend the exhibition to all members of the several associations in the marine field who have not yet formally agreed to co-operate with the Marine Equipment Association, including such bodies as the American Steamship Owners' Association, United States Steamship Operators' Association and Maritime Association. The Atlantic Coast Shipbuilders' Association through its secretary, Clarence Samuel King, on September 22 wrote to the Marine Equipment Association as follows: "We will be very glad to co-operate with you in this enterprise and towards that end offer you the facilities of this office in distributing tickets, invitations and any publicity matter which you may care to place in the hands of our members."

Further, the International Conference on the Limitation of Armament will be in session at Washington during the week of the marine show. It is estimated that several thousand men from all parts of the world will come to America because of the conference; and many of them have to do with ships and shipping when at home. Efforts will be made to get as many of the latter as possible to come to New York during "American Marine Week." Also, engraved invitations to review the exhibition will be sent to all foreign naval commissions and naval attachés to foreign embassies in this country.

Publicity Committee Appointed

President Simmons announced the appointment of a Publicity Committee, consisting of William A. Cather, Worthington Pump & Machinery Corporation, chairman; K. W. Heinrich, Bethlehem Shipbuilding Corporation, and C. H. M. Jones, Todd Shipyards Corporation. Also J. D. Sarles, Pyle-National Company, was made chairman of the Membership Committee, the other members of which will be appointed later.

On September 20 the joint committees of the Society of Naval Architects and Marine Engineers and Marine Equipment Association appointed by those bodies to agree on a joint program for the days on which the former organization will hold its annual convention (November 17 and 18) met at the Engineers' Club. Captain C. A. McAllister, chairman of the committee appointed by the Society of Naval Architects and Marine Engineers, presided. The others who attended the meeting were J. Howland Gardner, W. H. Todd and F. L. DuBosque of Captain McAllister's committee, and W. A. Cather (representing chairman M. L. Katzenstein), A. J. Barnes, Major F. C. Cheston and Colonel E. A. Simmons (president of the association, ex-officio) of the Marine Equipment Association committee.

Taxicab Service to Exhibition

It was decided that the joint committee had no jurisdiction whatever over the dinner scheduled for the night of November 18, that function being entirely within the control of the Society of Naval Architects and Marine Engineers. The question of entertainment for the ladies was left in abeyance pending receipt of information as to the possible attendance.

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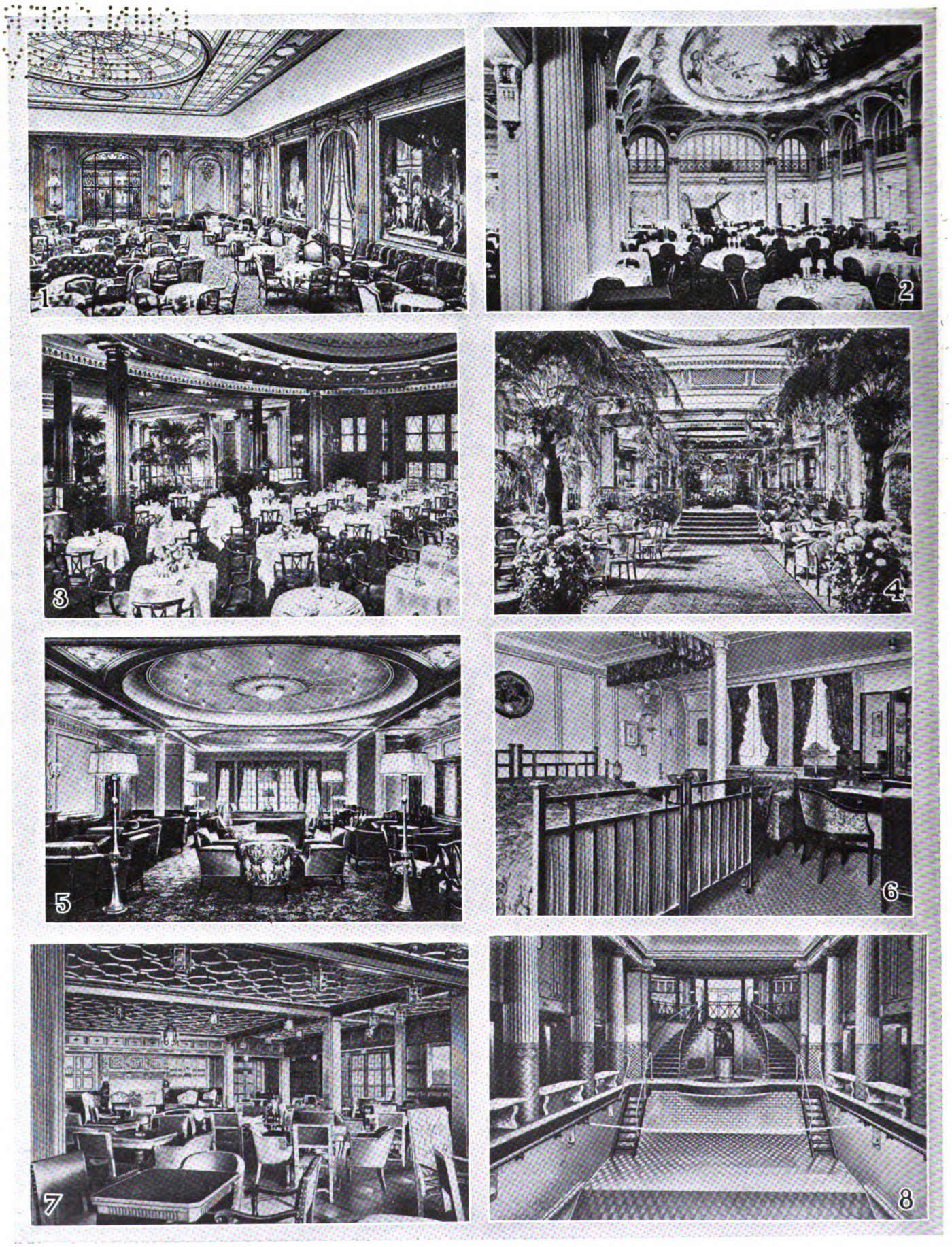

S. S. Majestic: Interior Views of First-Class Accommodations. (1) Lounge. (2) Dining Saloon. (3) Ritz-Carlton Restaurant. (4) Palm Court and Entrance to Ritz-Carlton Restaurant. (5) Reading and Writing Room. (6) Stateroom en Suite. (7) Smoking Room. (8) Swimming Pool.

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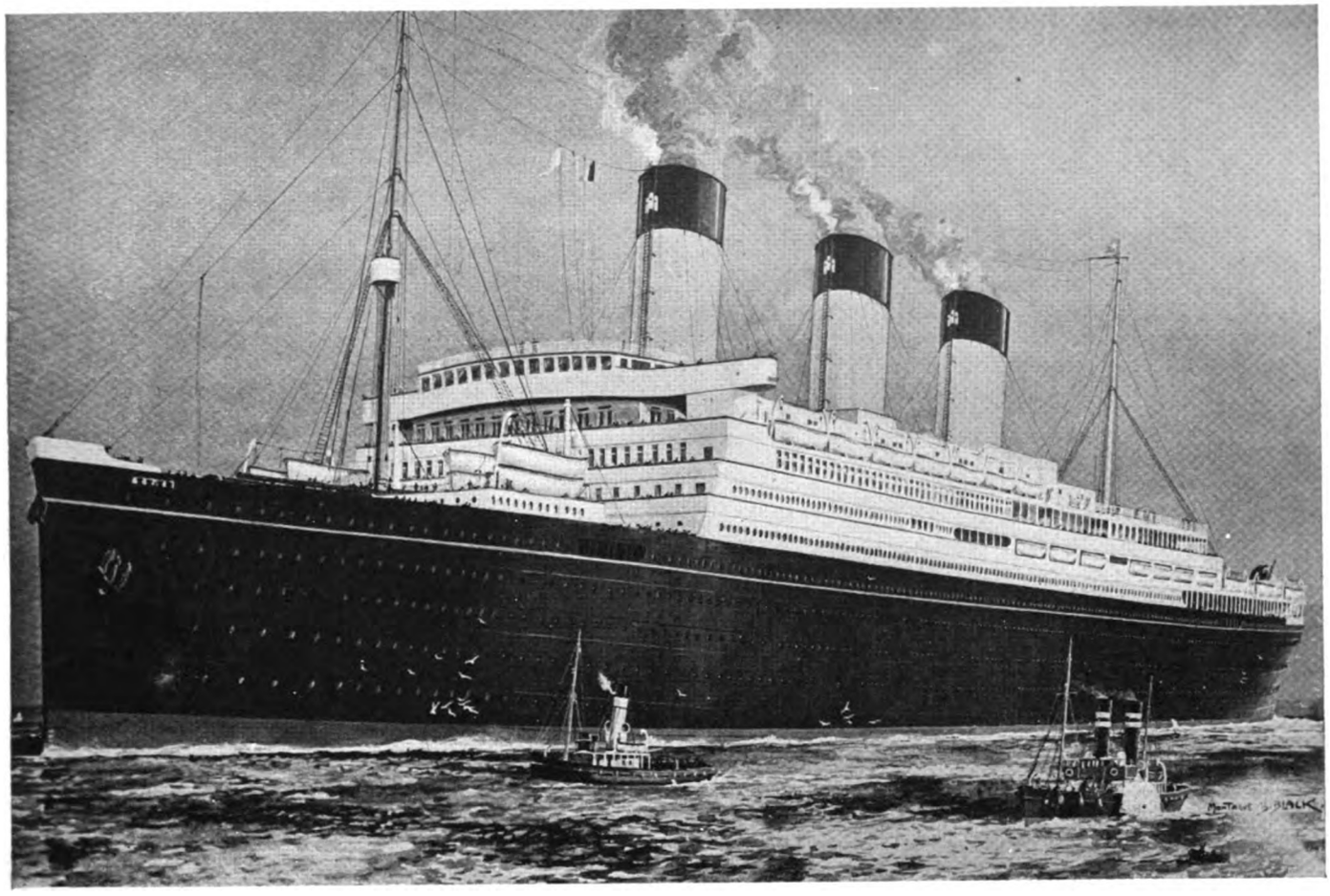

Sketch of the Majestic, the World's Largest Steamship, as She Will Look When Completed

White Star Liner Majestic

Largest Ship in the World Rapidly Approaching Completion at Hamburg

REPORTS recently received at New York by the International Mercantile Marine Company from the representatives of the White Star Line, who are supervising the completion at the yards of Blohm and Voss, Hamburg, Germany, of the 56,000-ton liner *Majestic* (ex-*Bismarck*), the world's largest ship, show that work is being pushed steadily on the mammoth vessel and that all indications point to her readiness for service between Southampton and New York next spring.

Despite the disturbed conditions in Germany, there has been no interference with the progress of work on the *Majestic*. Representatives of the White Star Line and of the German builders are working together to complete the ship which, in accordance with the terms of the peace treaty, will leave Hamburg as a finished product except for the outfitting with stores and minor equipment.

On taking her place in the New York-Cherbourg-Southampton service of the White Star Line, the *Majestic* will conform in the details of her passenger fittings to the standards established by the *Olympic*, with which she will ply in that service. As to size, however, she will stand alone since she is nearly 10,000 tons larger than the *Olympic* and about 2,000 tons larger than the *Leviathan*.

The hull of the *Majestic* conforms to the usual form above the waterline combined with the form of a warship of modern construction below the waterline. This was adopted as the most economical form of hull after careful model tank research work with five separate models in two different experimental stations, and represents the form of the last model which showed a saving of more than 17,000 horsepower in addition to a considerable increase in stability over the first model, these advantages being due to an alteration in the after body of the vessel for which the cruiser shape below the waterline was adopted.

Hull

The principal dimensions of this gigantic vessel are as follows:

Length overall	955 feet 9 inches
Length between perpendiculars	915 feet 9 inches
Breadth, molded	100 feet 0 inches
Depth, molded to D deck	70 feet 4½ inches
Draft, loaded	38 feet 6 inches

There are five steel decks running the full length of the hull and four superstructure decks in the center third of the hull.

The hull is subdivided into numerous watertight compartments connected by heavy doors that can be opened and closed quickly by hydraulic pressure electrically controlled.

Some of the miscellaneous items aboard the ship for which information is available and which will tend to show the massiveness of the vessel are as follows:

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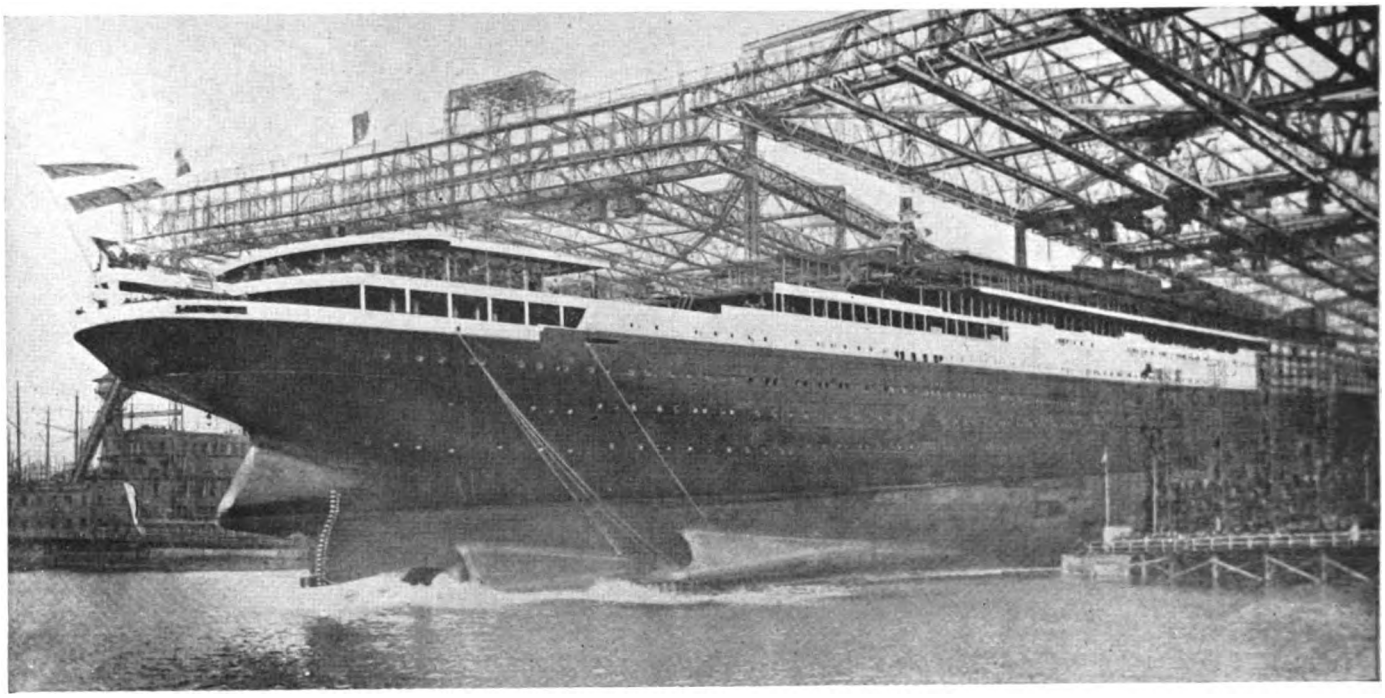

Launching of the Majestic. The Photograph Shows the Novel Form of the Ship's Stern At and Below the Waterline

The bow anchors weigh 15 tons each and the smaller anchors 10 tons each.

One chain cable for anchoring the vessel weighs 230 tons.

Wireless equipment of varying power is installed in three storage wireless stations on board and the ship will maintain constant touch with both Continents throughout an Atlantic voyage.

Safety devices against fire include deck coverings of composition capable of resisting the fiercest blaze and the glass in doors will resist 2,900 degrees of heat. Smoke detecting devices in various parts of the ship and 1,200 fire alarm points of which 450 are automatic connect with the central station.

A complete telephone system connects all parts of the ship.

The ventilating ducts throughout the vessel, which provide for constant changes of air, have a total length of 98,000 feet.

The height of the vessel from the keel to the boat deck is 102 feet and the smokestacks, of which there are three, are 30 feet in diameter, the tops being 144 feet above the waterline and 184 feet above the keel.

The topmost crow's nest on the foremast, reached by means of a ladder inside the mast, is 180 feet above the water and is the loftiest perch ever carried on a steamship.

Communication between the nine decks is facilitated by electric elevators, one of these being fitted in the engine room.

Accommodations

The accommodations aboard the *Majestic* provide for the carriage of 5,200 people, 4,100 of these being passengers and 1,100 crew. The first class accommodations provide for 1,000 passengers berthed in 472 staterooms; 700 second class passengers berthed in 212 staterooms and 2,400 third class passengers berthed in 561 staterooms and inclosed dormitories for single men and single women.

The staterooms range from a neat little one-bed room for a single traveler to elaborate suites of a half dozen rooms each with parlor, private sun veranda, dining room and bedrooms with private baths.

First, second and third cabins are each provided with separate galleys of which there are eight in all and for the second and third class cabins a kosher kitchen is maintained to serve Jewish travelers exclusively.

Accommodations are divided in the usual manner, the first class being located amidships; the second class towards the stern and the third class and steerage carried both forward and aft. The officers of the vessel are quartered in the steel house raised upon the bridge deck.

Luxury of Appointments

No pains are being spared to give the great ship the most luxurious of appointments. She will have a library of 4,000 volumes in a room designed for quiet; a large and elaborately fitted gymnasium; electric, Turkish baths; a Pompeian swimming bath of 820 square feet area and 9 feet deep with a capacity of 130 tons of sea water, which is built of mosaics and marble. About the swimming bath are provided 30 dressing rooms and a gallery overhead for the use of spectators. In addition there is a public veranda café on deck decorated with flowering shrubs and trailing vines; a play room for children fitted with nursery equipment of toys and furniture; a squash tennis court; special quarters for dogs and other pets; a conservatory for preserving flowers received by passengers on sailing; a card room for bridge whist and other games; a ball room and winter garden, and ample space for concerts with a stage adapted to motion picture exhibits or vaudeville.

Throughout the vessel there are in addition many little devices for luxurious service as, for example, numerous pantries from which refreshments, such as morning bouillon or afternoon tea can be served to passengers when on the decks or in the various public rooms.

Public Rooms

The public rooms of the ship are great halls in dimensions with clear spaces and lofty ceilings not usually associated with marine architecture. The lounge has a ceiling 26 feet high, its floor dimensions being 76 feet by 54 feet. The main dining room has an area of 11,466 square feet, being 117 feet long by 98 feet wide. Its ceiling for an area of 2,300 feet is 31 feet high. The restaurant for first class passengers is 110 feet long by 54 feet wide with a ceiling 23 feet high.

Throughout the center of these apartments there is an unbroken view 250 feet long. This is made possible by the peculiar construction of the vessel's smokestacks which are

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brought up from the boiler rooms near the sides of the ship in two parts that unite above the saloon deck. The grand staircases are also on the sides of the ship instead of in the center as in most vessels, thus insuring a clear sweep of unimpeded space for the great public rooms.

The smoking room on the *Majestic* is located forward with a commanding outlook ahead and on both sides through plate glass windows, differing in this respect from most vessels in which the smoking room is located farther aft.

CREW

While the exact number of persons that will be required to operate the ship has not definitely been fixed, it is thought her crew of approximately 1,100 will be divided as follows:

There will be required in the engine room about 275 men including engineers, oilers, water tenders and boiler room attendants, the latter tending the oil fires and replacing the old time coal shoveling firemen. As a coal burner the ship would require an engine room force of about 460 men.

In the deck department, including navigating and other officers and sailors, will be about 140 men.

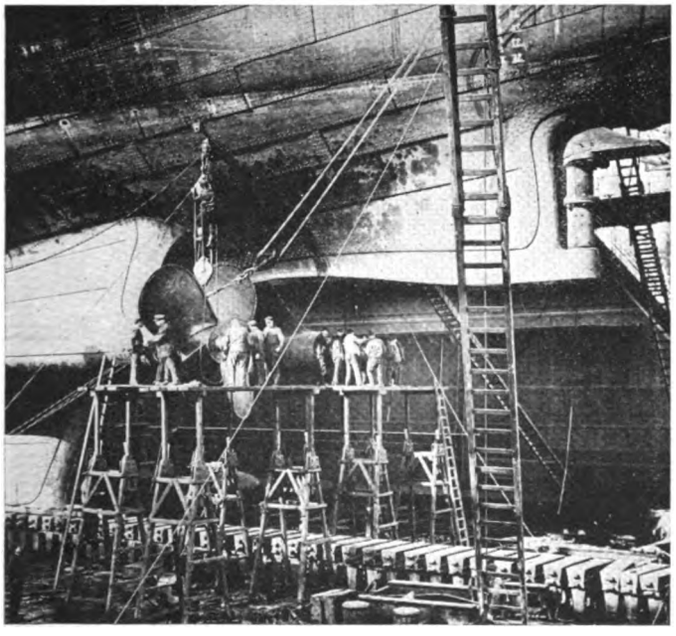
The stewards' department, including cooks, bakers, butchers, serving men, table stewards and room stewards, will be composed of about 650 men and about 25 women, the latter employed as stewardesses. Not less than 70 cooks, about 25 bakers and 15 butchers will be required in the ship's eight galleys.

PROPELLING MACHINERY

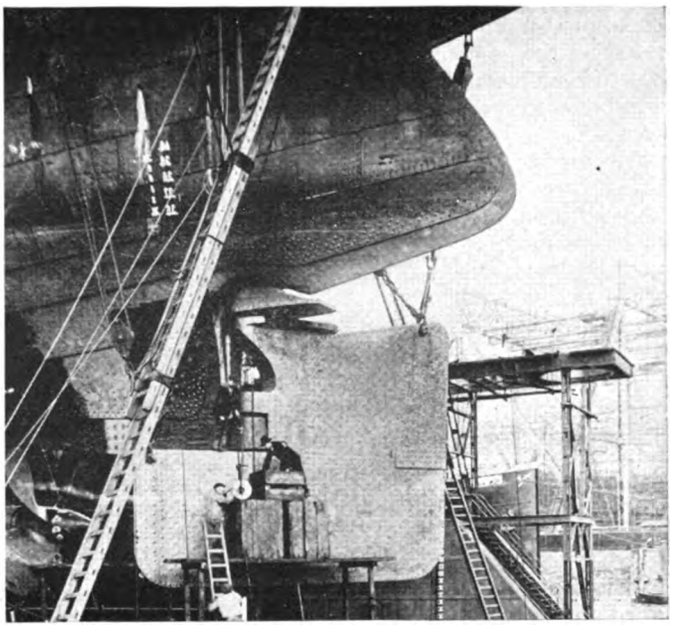
The *Majestic's* power plant, which is the largest ever fitted in a passenger vessel, will consist of eight Parsons turbines built under license by Messrs. Blohm and Voss. These turbines will drive four lines of shafting, each transmitting about 15,500 horsepower to a manganese bronze propeller of about 16 feet in diameter at 170 revolutions per minute. There will be two turbines attached to each shaft, one of which will be used for reversing.

The working combination of the turbines will be a triple expansion and they are arranged so that there is one high pressure ahead turbine on the port inboard shaft, one intermediate pressure turbine on the starboard inboard shaft and two low pressure turbines connected to the wing shafts.

The steam enters the high pressure turbine, is led from the latter to the intermediate pressure turbine and is then divided and led in equal parts to the two wing low pressure turbines and from there to the condensers, this arrangement of direct drive of the turbines providing for the highest degree of economy possible with this type of machinery.



Shipping the Port Inboard Propeller on the Majestic



The Majestic's 140-Ton Rudder Is of the Balanced Type

With a power of about 62,000 to 64,000 horsepower the vessel will be driven at an average speed of 23 to 23½ knots. It is possible, however, to maintain without difficulty higher power and speed when burning oil. By developing 91,000 horsepower at 192 revolutions per minute at normal draft, the ship should attain nearly 26 knots under favorable weather conditions.

The eight turbines are arranged in three watertight compartments having a total length of 124 feet and on the starting platform of the main turbine room there is an indicator showing automatically by colored lights the action of the various units.

There are three specially noticeable figures with respect to the turbines, one of which is the weight of 375 tons of the low pressure turbine; the second is the greatest free length of one blade which is 2 feet and the third is the number of blades in all the turbines which amounts to 900,000.

BOILERS

The boiler plant, consisting of 48 watertube boilers of the Yarrow type, represents a total heating surface of about 220,000 square feet and a grate area of about 4,000 square feet. The working pressure is 265 pounds per square inch, which is purposely high to allow for losses in the main steam pipes which are nearly 300 feet in length. As the boilers are fitted to burn oil fuel, the bunkers which were originally designed and finished for coal, have been adapted for oil.

The weight of the complete main engine and boiler plants amounts to 8,500 tons. Adding to this, however, all necessary weights for driving the ship, including hatches, funnels, bunkers and their contents, feed water, auxiliary machinery, crew and their quarters, etc., the total weight amounts to about 22,000 tons or 45 percent of the total weight of the ship.

In connection with the fuel consumption, which will be about 5,700 tons of oil on one passage, the necessary water ballast service is of interest. Upon leaving the harbor the ship will displace as a rule about 63,000 tons and the consumption of fuel, fresh water and provisions for the passage will be about 8,000 tons. This will be restored, as far as necessary for safe navigation of the ship, by putting 3,300 tons of water ballast into the double bottom compartments.

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The main condensers receive their cooling water from large circulating pumps with a collective capacity of 22,000 tons per hour, the suction and pressure pipes of these pumps being 3¼ feet in diameter. There are four of these condensers which receive the steam from the low pressure turbines and which have a collective cooling surface of 66,000 square feet or about one square foot for each horsepower developed by the engines.

Another of the more important auxiliary elements in the main machinery is the forced draft for the boiler plant. There are four powerful fan arrangements drawing fresh but warm air from the turbine rooms; this is forced through two main air channels of 45 square feet area having a collective length of 1,000 feet. Besides this air service for the boilers there is another installation providing air for the crew working in the boiler rooms. The ventilation of the turbine rooms has been arranged with the same care, two large electric fans being provided whose ventilating trunks are placed in the turbine hatch ending at the foot of the third funnel 136 feet above the starting platform of the turbine room.

Heating and Refrigerating Systems

Closely connected with ventilation is cooling and heating. For the purpose of preserving the fresh provisions there is a steam-driven CO_2 refrigerating installation capable of extracting 100,000 calories an hour. A second electrically driven installation for the refrigerated forward cargo holds has a capacity for extracting 60,000 calories per hour.

The heating of the accommodations is provided by steam but all first class staterooms are also electrically heated. Each passenger can regulate this heating to suit himself.

The electrical installation consists of five turbo generators each of which develops 288 kilowatts at 115 volts at 2,000 revolutions per minute. The main switchboard is 22 feet long by 8 feet high and the collective section of all 32 feed cables leaving the switchboard is 15,000 square millimeters, whose collective value is 2,850 kilowatts. Twenty-two of these main cables are for power purposes, six are for the 15,000 lights on board and four for heating purposes. The power cables are connected to the following motors:

102 motors for ventilation, with a total horsepower of 955.
8 motors for turning and lifting the main turbines, representing 198 horsepower.
30 motors for auxiliary machinery in the galleys, with a total of 60 horsepower.
10 motors for the boat installation, developing 200 horsepower.
4 motors for the ozone-installation, developing 14 horsepower.
18 motors for elevators and winches, with 38 horsepower.
52 motors for various purposes, requiring about 100 horsepower.

The above represents a grand total of 224 motors with an aggregate capacity of 1,565 horsepower.

Besides the main electric generating station, there is an independent Diesel emergency installation of 80 horsepower which is located 19 feet above the bulkhead deck and which feeds 800 emergency lamps distributed about the vessel and is also connected to the boat machinery, the navigating and signalling elements and the emergency wireless installation. There are three independent dispatch installations, one of which is fed by an accumulator battery placed on an upper deck. Each of the three sender-installations has its own system of aerials, the largest of which has a length of 630 feet stretched between the masts of the vessel.

Marine Exposition a Combined Maritime Gathering

(*Continued from page* 733)

As to the exhibition, it was decided to designate Thursday, November 17, from 4 p. m. to 7 p. m.; Friday, November 18, from 10 a. m. to 7 p. m., and Saturday, November 19, from 10 a. m. to 7 p. m. as "Naval Architects' Days." For the convenience of those who attend the annual convention of the Society of Naval Architects and Marine Engineers, the Marine Equipment Association will operate a taxicab service between the Engineering Societies Building, where that society will meet, and the Central Mercantile Building, where the exhibition will be held. The Executive Committee of the Marine Equipment Association had previously decided to open the exhibition at 10 o'clock each morning, except on the first day, when the opening hour was set at two o'clock in the afternoon and to keep it open until 11 o'clock at night —the general public to be admitted only during the evenings, after seven o'clock. By this arrangement it will be possible for exhibitors to talk in comfort to customers and prospective customers between 10 a. m. and 7 p. m., while on the other hand there will be ample opportunity during the six evenings to exert every effort to educate the citizenry in the matter of the necessity for a real American merchant marine.

Navy and Shipping Board Co-operate

Following the conference at the Engineers' Club, Colonel Simmons went to Washington to confer with the Secretary of the Navy and officials of the United States Shipping Board with reference to exhibits that would get and hold the attention of the public and help to further the determination of the Marine Equipment Association working in conjunction with the National Marine League, to show the general public the necessity for an American merchant marine. As a result of the conference, both Mr. Denby and the Shipping Board agreed to exhibit and to otherwise co-operate in every possible way.

Shackleton's Antarctic Exploration Craft Quest, Anchored in the Thames

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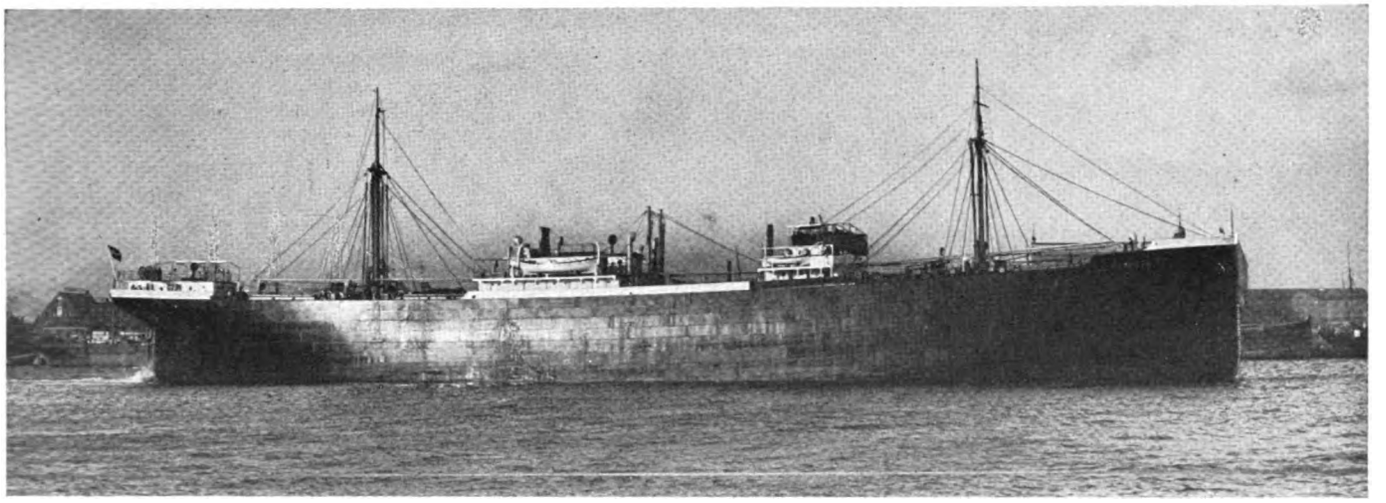

Fig. 1.—Motorship Formosa in Ballast

Twin Screw Motorship Formosa

9,800 Deadweight Ton Vessel a Representative Type of Modern Cargo Motorship

THE motorship *Formosa*, built by Burmeister and Wain of Copenhagen for the Swedish East Asiatic Company, is characteristic of modern methods as applied to motor cargo ships and represents a type of which a great number have been built for the East Asiatic Company, the United Steamship Company of Copenhagen and Fred Olsen & Company of Christiana. In addition, there are more ships of the same type on order for Scandinavian owners.

The *Formosa* has been built to Lloyd's class 100 A.1 as awning deck with freeboard, is fitted with three decks and five holds and has two masts. No funnel is provided other than a small one from the donkey boiler, to the top of which the exhaust pipes of main and auxiliary Diesel engines are carried.

Accommodations for the officers are provided in a deck house below the bridge at the sides of the engine casing and the crew is berthed aft in staterooms, two men to a room.

Machinery Installation

The propelling machinery consists of two main engines of Burmeister and Wain's standard six cylinder, four cycle, single acting, enclosed crosshead type fitted with forced lubrication.

To the fore end of each engine is coupled a three-stage air compressor for injection air and further the engines are fitted with fuel oil pumps, one for each cylinder.

Auxiliaries

All auxiliaries, other than the above and an auxiliary compressor, are independently driven by electricity, the motors for which are of the enclosed type built especially for the tropics.

It will be noted from the data sheet (page 741) that two cooling water pumps and two sets of forced lubricating oil pumps are provided. During daily working at sea it is only necessary to have one cooling water pump and one set of

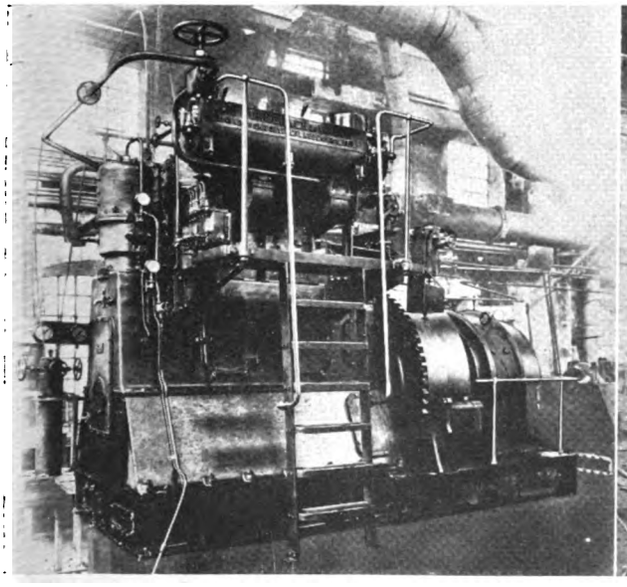

Fig. 2.—Diesel Engine Driven Generator

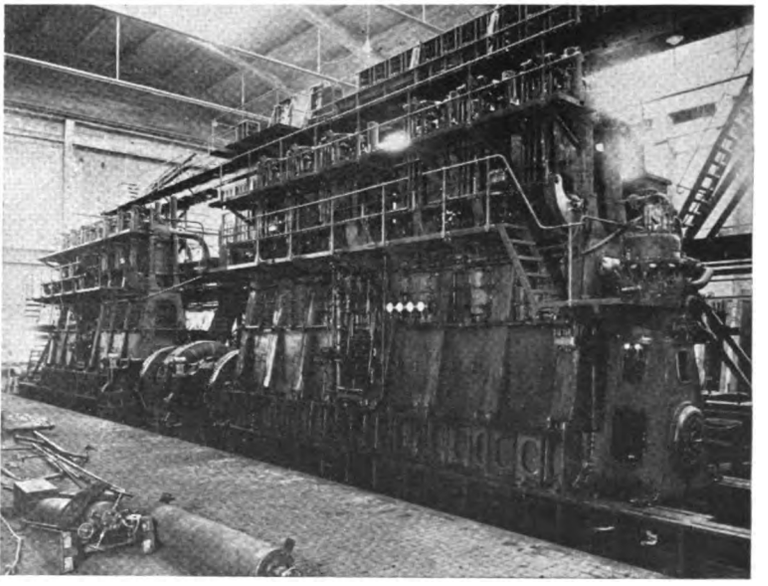

Fig. 3.—Main Engines Erected in the Shop

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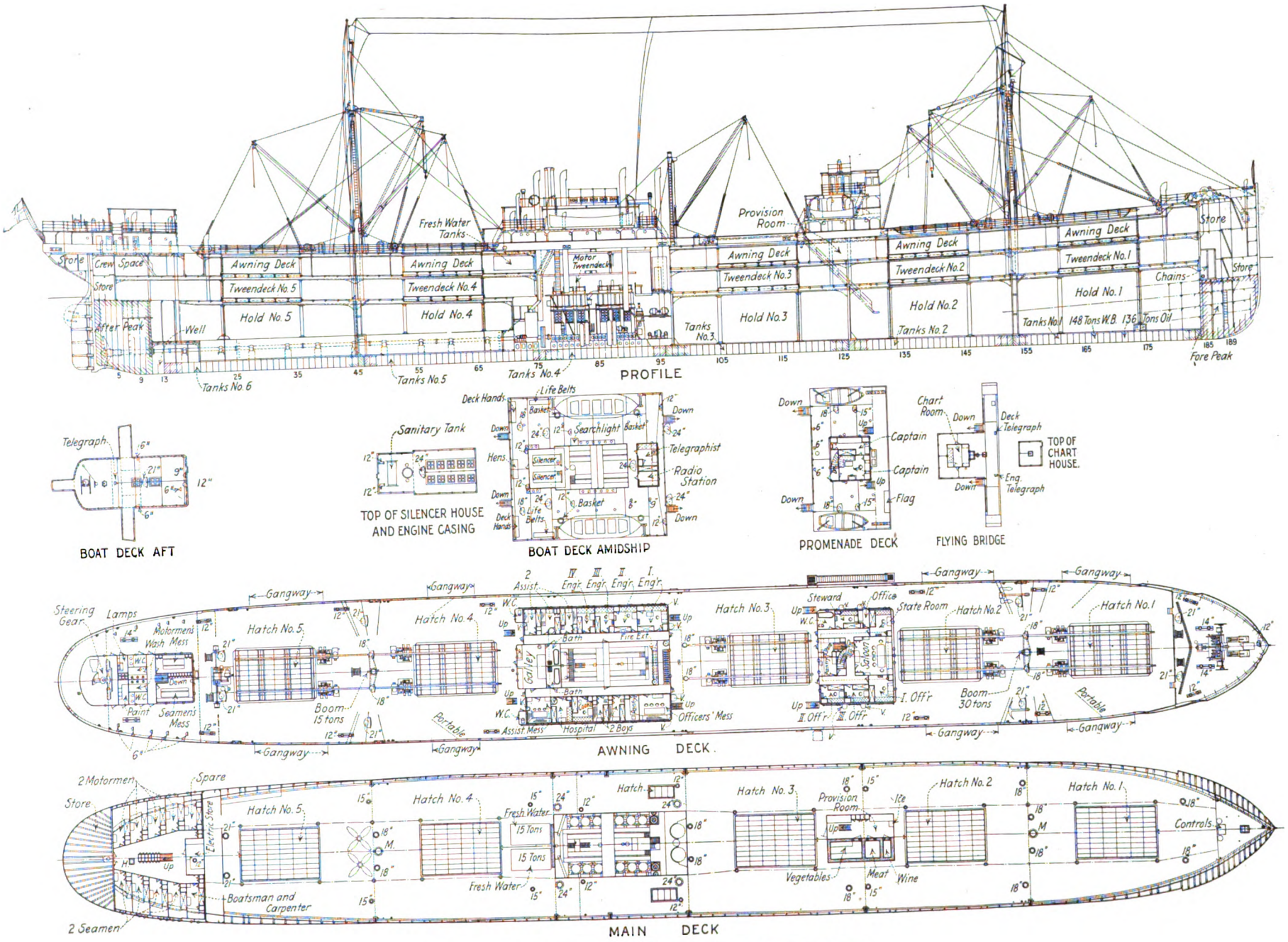

Fig. 4.—Profile and Deck Plans of Motorship Formosa

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Twin Screw Motorship Formosa

General Information

Service: Freight to East Asia.
Builder: Burmeister and Wain, Copenhagen, Denmark.
Owner: The Swedish East Asiatic Company, Gothenburg, Sweden.

Characteristics

Length, overall .....442'-6"
Length, B. P.....425'-6"
Breadth, molded .....55'-0"
Depth, molded, awning deck.....38'-6"
Depth, molded, upper deck.....30'-6"
Depth, molded, lower deck.....21'-9"
Height, double bottom.....3'-8"
Draft, loaded .....29'-0½"
Draft, light .....
Block coefficient .....
Midship section coefficient .....
Longitudinal coefficient .....
Speed, loaded, knots 11.5
Cruising radius, nautical miles.....30,000
Framing .....Transverse
Class .....100 A-1 Lloyd's awning deck with freeboard

Tonnages

(In tons of 2,240 pounds)

*Weight of Hull .....
**Weight Propelling Machinery .....
Deadweight Capacity.....9,800
Displacement 14,960

(In tons of 100 cubic feet)

Gross register .....
Net register .....

*Weight of Hull includes Hull Proper, Hull Fittings, Equipment and Outfit.
**Weight of Propelling Machinery includes Engines, Boilers (Wet), Shafting, Propellers, and Machinery Space Auxiliaries.

Canal Ratings

(In tons of 100 cubic feet)

	Gross	Net
Suez		
Panama		

Equipment

Anchors .....
.....
.....
.....
Chain .....
.....
.....
.....

Rudder

Area .....
Dia. Stock .....
C. Press. abaft C. L. pintles.....

Complement

Deck officers 4
Wireless operators 1
Deck crew 10
Engineer officers 10
Engineer crew 8
Purser's and steward's department..... 6
Total officers and crew 39
First-class passengers .....
Second-class passengers .....
Third-class passengers .....
Total passengers .....
Total complement 39

Handling Equipment

	No.	Type	Capacity Length
Masts	2	Pole	
Derrick posts	2	Ventilating	
Booms	1		30-ton
Booms	1		15-ton
Booms	10		5-ton

Deck Machinery

Steering Gear.....Electric hydraulic
Windlass ..... Electric
Capstans .....
Winches, electric, 5-ton.....3
Winches, electric, 3-ton.....8

Life Saving Equipment

	No.	Type	Length
Lifeboats	2		30'-0"
Dinghy	2		18'-0"
.....			
.....			

Propelling Machinery

Boilers

Number 1
Type .....Donkey
Length .....
Width or Diameter .....
Furnaces .....
Fuel ..... Oil
Draft .....
Total heating surface, square feet .....
Total grate surface or furnace volume .....
.....
Superheat, degrees F. .....
Working pressure, lbs. per sq. in .....
Normal fuel consumption:
Per day, tons, total..... 10.5
Per horsepower hour, pounds .....
Normal steam production:
Per hour per pound of fuel .....lbs
Total per hour .....lbs.

Engines

Number 2
Type, 6 cyl., 4 cyc., single acting, enclosed crosshead .....
Size,.....Bore 24.8", stroke 37.8"
Horsepower, total indicated.....3,100

Propellers

Number 2
Type .....4 bladed, solid
Weight .....
Diameter .....
Pitch .....
R. P. M..... 125
Projected area .....
Developed area .....

Auxiliary Machinery

Machinery Space

Condensers .....
.....
.....
Evaporators .....
Distiller .....
Filters .....
Feed water heater .....
Fuel oil heaters .....
.....
Pumps:
(2) Centrifugal cooling water, directly coupled to motors.
(2) Sets, of 2 each, lubricating oil, rotary type.
(1) Fuel oil transfer, capacity 50 tons per hour.
(1) Ballast, rotating wing type, driven through gears, capacity 150 tons per hour.
(2) Bilge and sanitary triple plunger type.
(1) Maneuvering air compressor—2 stage.
(1) Emergency air compressor.
(1) Motor generator.

Refrigerating Machinery

One machine for ship's use.

Electric Equipment

Generators, three 60 k. w., 220 volts, each direct connected to a 90 B. H. P. Diesel engine.
Radio .....
Emergency .....

Holds

No.	Length	Hatches
1	28'-8½"x18'-0"	
2	28'-8½"x18'-0"	
3	28'-8½"x18'-0"	
4	28'-8½"x18'-0"	
5	28'-8½"x18'-0"	

Capacities

Cargo Space

Compartment	Cu. Ft. Grain	Cu. Ft. Bales
Awning deck 136,100		120,500
'Tween deck No. 1..... 26,500		23,800
'Tween deck No. 2..... 27,700		24,700
'Tween deck No. 3..... 29,600		26,500
'Tween deck No. 4..... 30,300		27,100
'Tween deck No. 5..... 30,100		26,100
Motor, 'tween deck..... 8,200		7,600
Hold No. 1..... 55,500		51,100
Hold No. 2..... 62,700		58,600
Hold No. 3..... 63,800		59,600
Hold No. 4..... 56,600		52,400
Hold No. 5..... 45,600		41,600
Total 572,700		519,600

Refrigerated Space

Compartment	Cu. Ft.
Ship's provisions	
.....	
.....	

Bunkers

Compartment	Cu. Ft.	*Bbls.	*Tons
Dble. bottom tanks No. 1.....			136
Dble. bottom tanks No. 2.....			222
Dble. bottom tanks No. 3.....			272
Dble. bottom tanks No. 4.....			154
Dble. bottom tanks No. 5.....			240
Dble. bottom tanks No. 6.....			128
Total			1,152
.....			
.....			
.....			

*....cu. ft. per ton;.....gals, per bbl.

Tanks

Compartment	Cu. Ft.	Tons F. W.	Tons S. W.
Fore peak			84
Dble. bottom tanks No. 1.....			148
Dble. bottom tanks No. 2.....			240
Dble. bottom tanks No. 3.....			296
Dble. bottom tanks No. 4.....			168
Dble. bottom tanks No. 5.....			260
Dble. bottom tanks No. 6.....			138
After peak			80
Separate F. W. tanks.....		30	
Total		30	1,414

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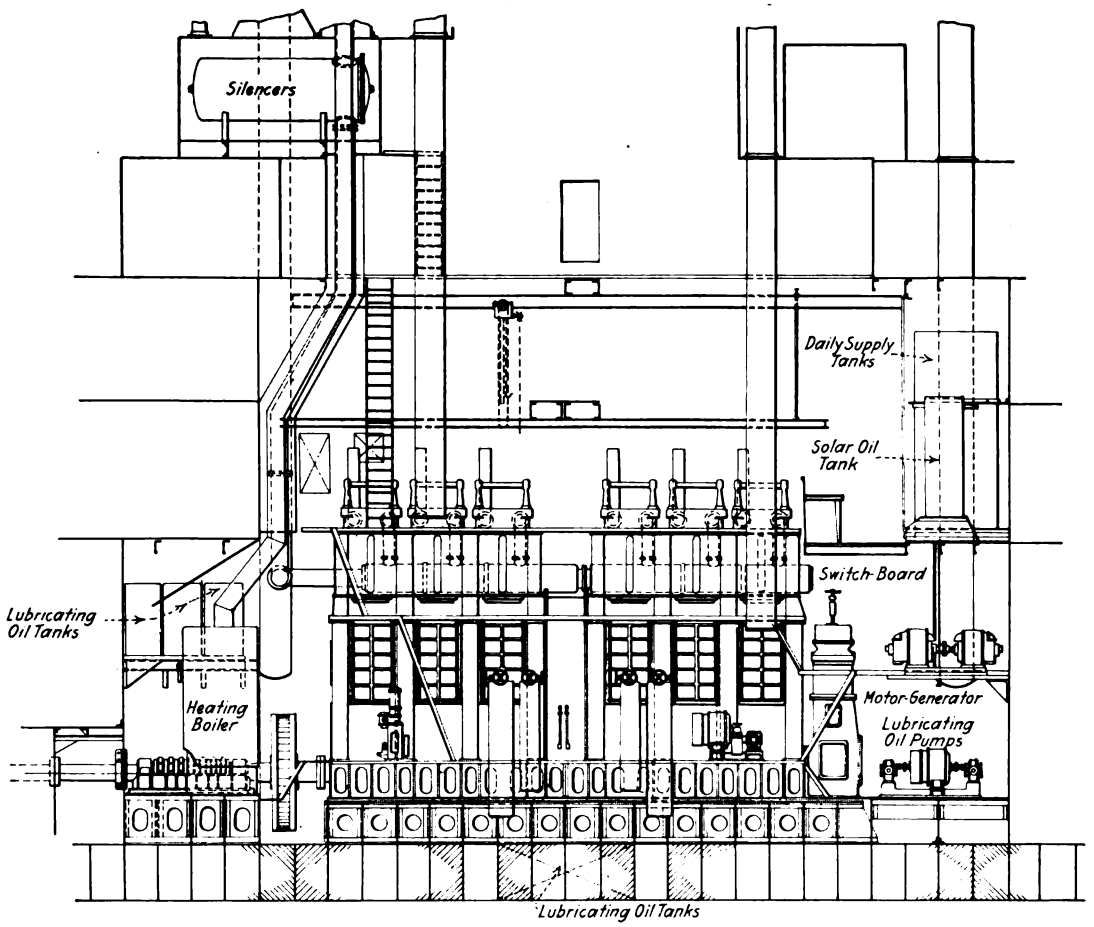

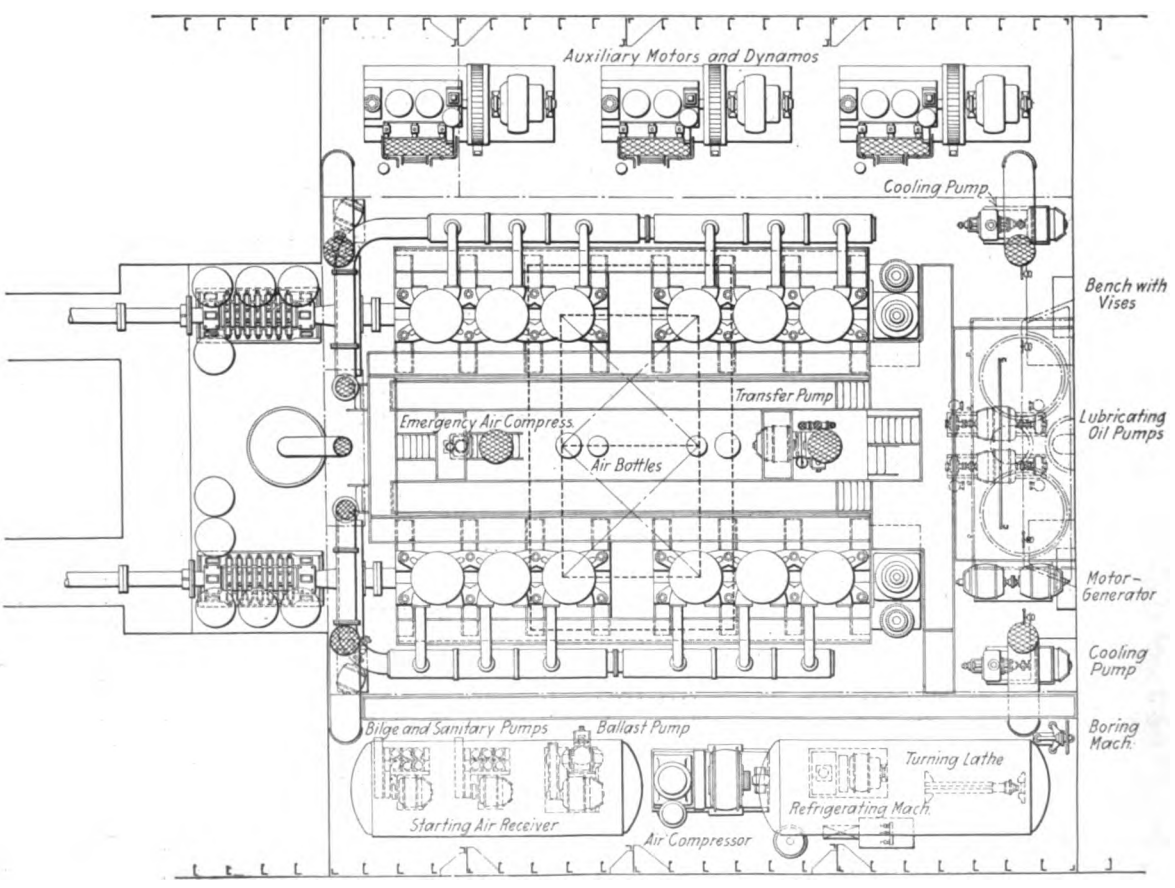

Fig. 5.—Plan and Elevation of Engine Room, Motorship Formosa

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forced lubricating pumps at work, the others being provided as spares to guard against emergencies.

The fuel oil transfer pump is also connected by manifolds to permit its use for trimming the ship by transferring oil from one tank to another.

Ample provision is made for supplying the necessary air for starting and maneuvering the vessel under all conditions. In addition to the three-stage compressor directly coupled to the main engines, a two-stage, motor driven compressor for maneuvering air is installed.

For use in the event of all the air being blown from the air bottles, as may happen when the vessel is laid up for a long period, a steam driven auxiliary compressor capable of pumping up one set of air bottles for the auxiliary Diesel engines is fitted. This compressor can produce enough air in two hours to start one of the auxiliary Diesel engines and then the whole plant can be started. Steam for the auxiliary compressor is taken from the donkey boiler which is also used to provide heat throughout the vessel. Oil fuel is used for firing the donkey boiler and the burners are designed to permit the use of either steam or air for atomizing.

Two settling tanks are located on the forward engine room bulkhead and each has sufficient capacity to supply the machinery for 12 hours, thus allowing the oil to stand 12 hours for settling water and dirt before use in the engines.

Between the settling tanks a smaller tank of light oil is carried for use in starting, in this manner overcoming the starting difficulties which are common with the use of thick, heavy, crude oil, particularly in cold weather.

Electric Plant

The electric plant aboard the *Formosa* consists of three generators of 60 kilowatts at 220 volts capacity. Each generator is direct connected to a 90 brake horsepower, enclosed, trunk piston, forced lubricated Diesel engine of the Burmeister and Wain standard auxiliary type.

The generators are mounted on common bed plates with the Diesel engines and the size of the units is such that any two of them are sufficient for driving all the deck machinery in port and all the auxiliary machinery when maneuvering into or out of port. During daily working at sea it is necessary to have but one unit working and thus there is a full spare under all conditions.

The switchboard with instruments for distributing the electric current from the generators to the auxiliary machinery, deck machinery, lighting system, wireless installation, etc., is located at the forward end of the engine room below the settling tanks and a rotary transformer is fitted for reducing the current for the lighting installation from 220 to 110 volts.

Deck Machinery

Eleven electric winches, made by Allmänna Svenska Elektriska Aktiebolaget, Sweden, are provided.

The windlass is of the Clarke-Chapman type, electrically driven and the steering gear a Brown Brothers electric-hydraulic gear with a continuously running motor coupled to a hydraulic pump.

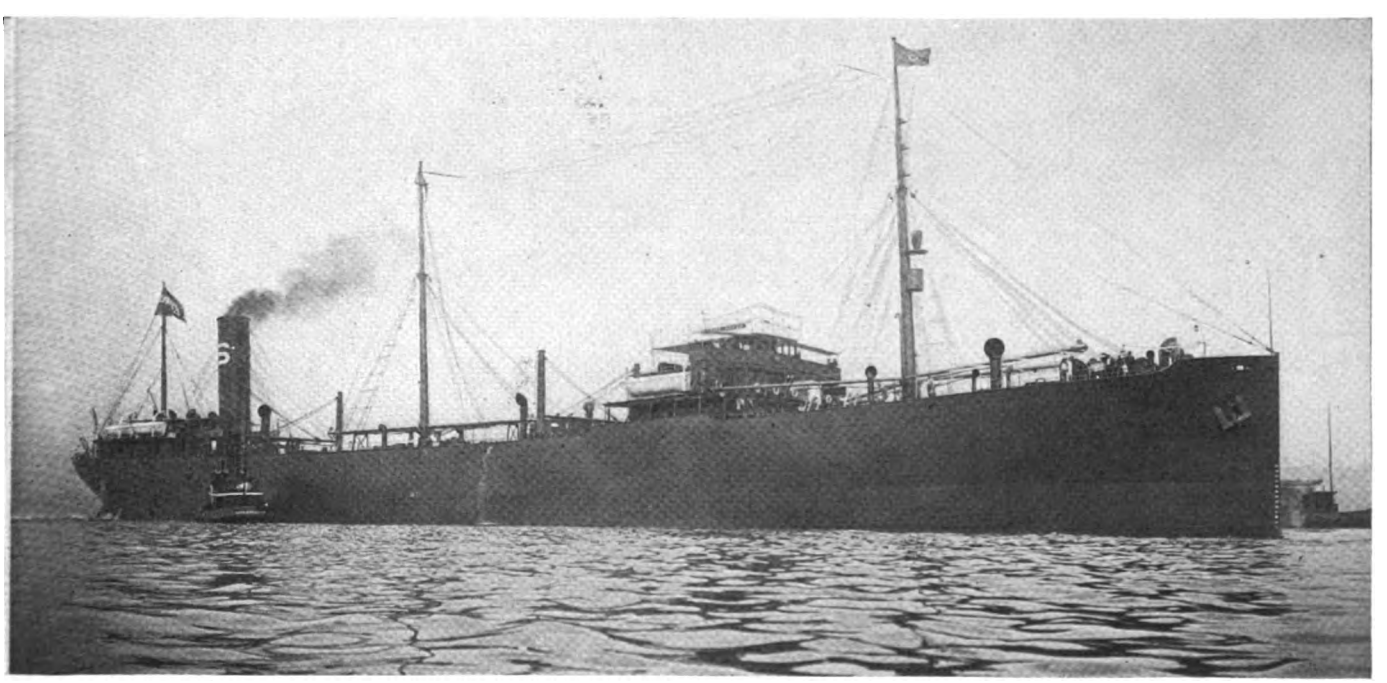
An interesting situation arose about the time the *Formosa* was preparing for her first voyage when the engineers in Sweden went on strike.

The ship sailed, however, after drawing four engineers from the technical college at Stockholm, who had never sailed before or had any training in attending such an installation, and one guaranty engineer and eight men from Burmeister and Wain's works. No difficulty was experienced due to lack of training in the engine room.

Standard Oil Tanker Empire Arrow

THE illustration below shows the oil tanker *Empire Arrow,* built for the Standard Transportation Company, New York, at the plant of the New York Shipbuilding Corporation, Camden, N. J.

The overall dimensions of the ship are: Length, 485 feet; beam, 62 feet 6 inches; depth, 39 feet 6 inches. She is equipped with three single end Scotch boilers and one 3,200 indicated horsepower engine of the four cylinder, quadruple expansion, four crank direct acting, surface condensing type. This engine is capable of propelling the vessel, loaded to the specified draft, at a speed of 11 knots. The vessel will have ten double main cargo tanks with a combined capacity of 3,500,000 United States gallons. Her displacement is 18,277 tons and she carries a crew of 62 men.



Oil Tanker Empire Arrow on Her Trial Trip

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Interior Views Showing the Passenger Accommodations On

(1) Library and Writing Room. (2) Second Class Social Hall. (3) Social Hall, Forward End. (4) Smoking Room. (5) Dining Room. (6) Social Hall, After End. (7) Second Class Lounge

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The American Transatlantic Steamship George Washington

(8) Navigating Bridge. (9) Promenade Deck. (10) Suite de Luxe. (11) Stairway to Smoking Room. (12) Veranda Café. (13) Two-Berth Stateroom. (14) De Luxe Bedroom

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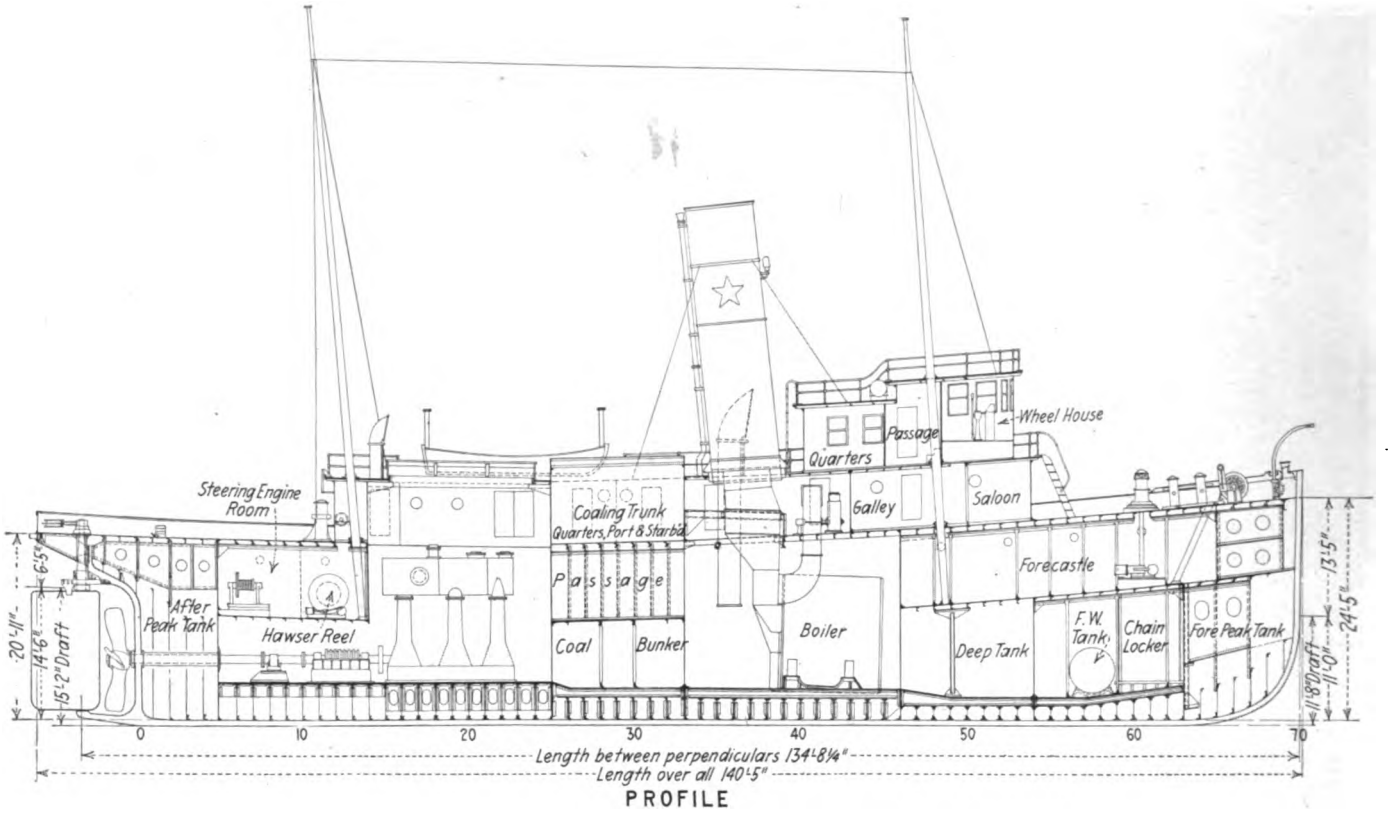
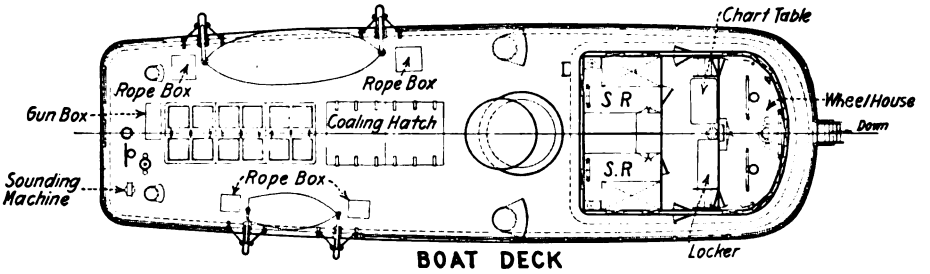
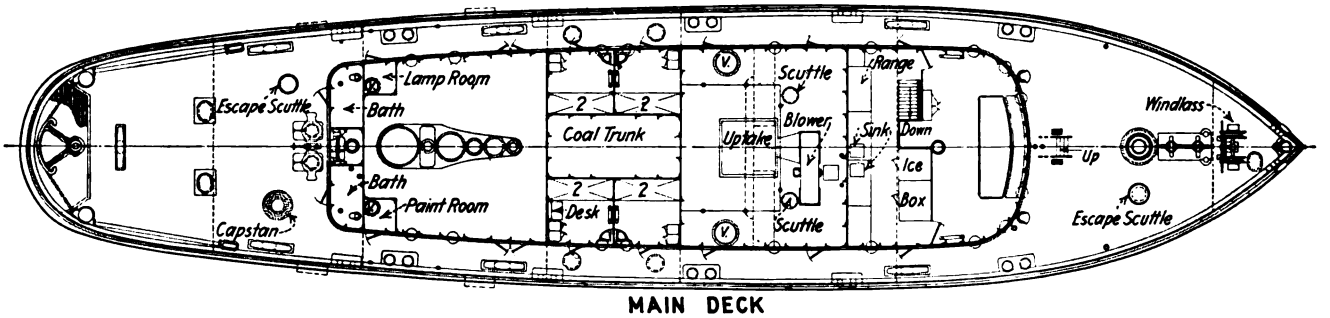


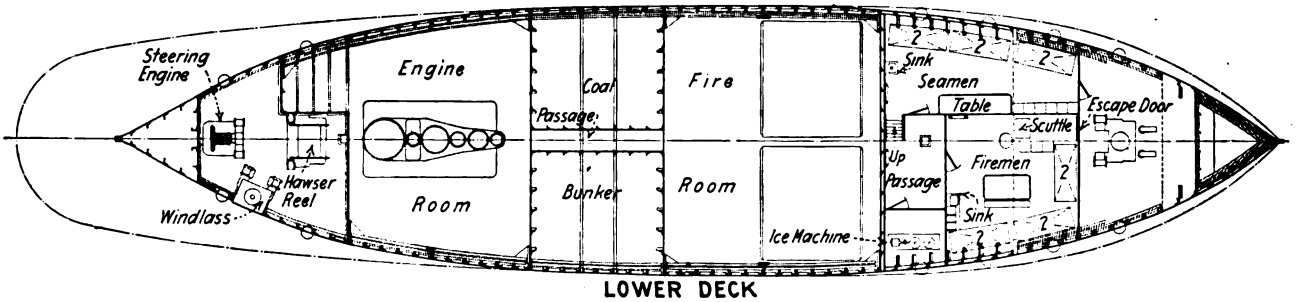
PROFILE



BOAT DECK



MAIN DECK



LOWER DECK

Profile and Deck Plans of Sea-Going Tug Adler

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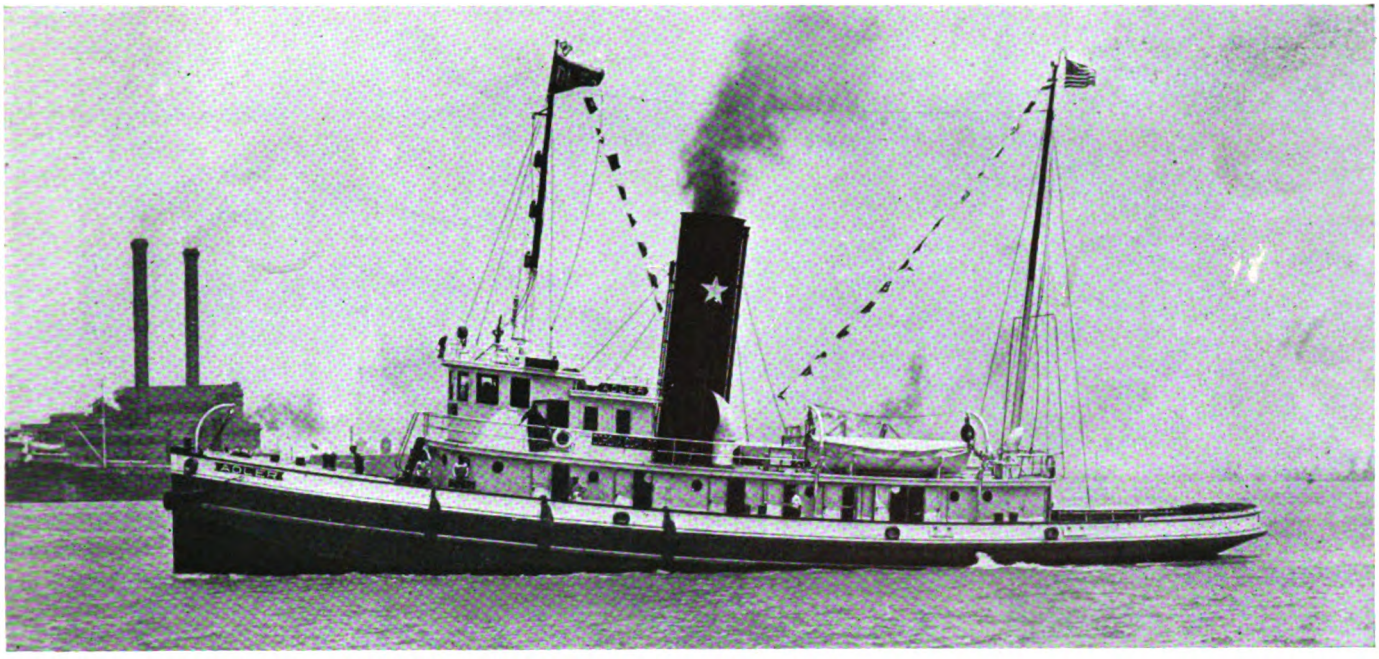

Tug Adler, Designed for Ocean Towing and Salvage Work

Sea-Going Tug Adler

Under normal stages of water in the Mississippi River there are currents and eddies to be contended with in the movement of vessels up and down the river and about the harbor; and when the river is high the conditions are occasionally quite severe. In addition to the difficulties sometimes attending the handling of vessels in the currents and eddies of the river, the increased size of many of the ships sailing out of New Orleans has made it necessary to provide powerful tugs to facilitate vessel movements and recent additions to the tugboat fleet are for the most part amply able to meet the requirements of their service in the harbor. But as the River and Ocean Towing Company, in considering an addition to their fleet, desired to provide for ocean towing and for salvage and wrecking operations about the passes of the lower river, the tugboat Adler, described below, was especially designed for these purposes.

THE Corona Coal Company, of Birmingham, Ala., operates at New Orleans through two subsidiaries, the River Coal Company supplying bunker coal to ocean-going vessels and the River and Ocean Towing Company handling the tugs, barges and coaling equipment used in the delivery of the coal from rail points to the ships. Conditions in the harbor of New Orleans necessitate frequent shifting of vessels in the loading and discharge of cargoes, as well as in bunkering, and much of this shifting naturally devolves upon the bunkering organizations. These companies maintain for this purpose quite a considerable fleet of tugboats, and with the constant increase of tonnage in the port the tugboat fleet is being augmented to keep pace with the requirements.

The sea-going tug *Adler*, recently placed in the service of the River and Ocean Towing Company, represents the latest practice in construction for this type of vessel. Exceptionally complete in all details, the *Adler* is built entirely of steel and was constructed under special survey to the rules of the American Bureau of Shipping, receiving class ✠ A. 1 tug service ✠ AMS.

Dimensions and Hull Data

The principal dimensions and hull data of the *Adler* are as follows:

Length overall	140 feet 3 inches
Beam molded	30 feet 0 inches
Depth (least)	18 feet 9 inches
Draft forward	11 feet 8 inches
Draft aft	15 feet 2 inches
Freeboard forward (to main deck)	13 feet 5 inches
Displacement (to above draft)	792 tons
Tons per inch of immersion	7.2 tons
Block coefficient	0.56
Midship area coefficient	0.86
Prismatic coefficient	0.65
Load waterline area coefficient	0.78

Hull

The hull is constructed of medium open hearth steel tested to classification requirements.

It is divided by transverse watertight bulkheads into seven compartments, namely, fore peak, forward hold, deep tank, boiler room, coal bunker, engine room and after peak. The peak tanks are arranged to carry fresh water for boiler feed, while the deep tank is arranged for water ballast or fuel oil in case liquid is burned.

The after body is fined away considerably, the run starting practically amidships, this shape assuring a proper flow of water to the wheel and producing a small stern wave.

Forward of the boiler room and aft of the engine room a second deck is fitted and a stringer is carried on the second deck line through the machinery space and coal bunker.

A pipe and access tunnel is arranged below the upper deck through the coal bunker, and this tunnel is the only means of communication between the boiler room and the engine room except by going on the weather deck. Sliding water-

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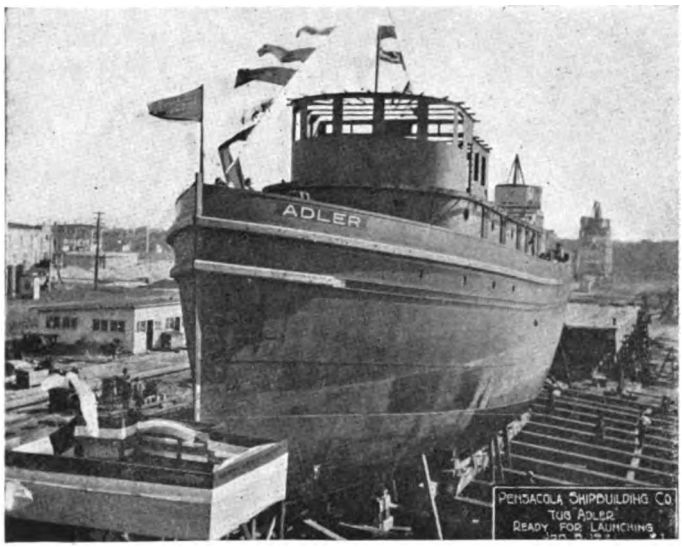


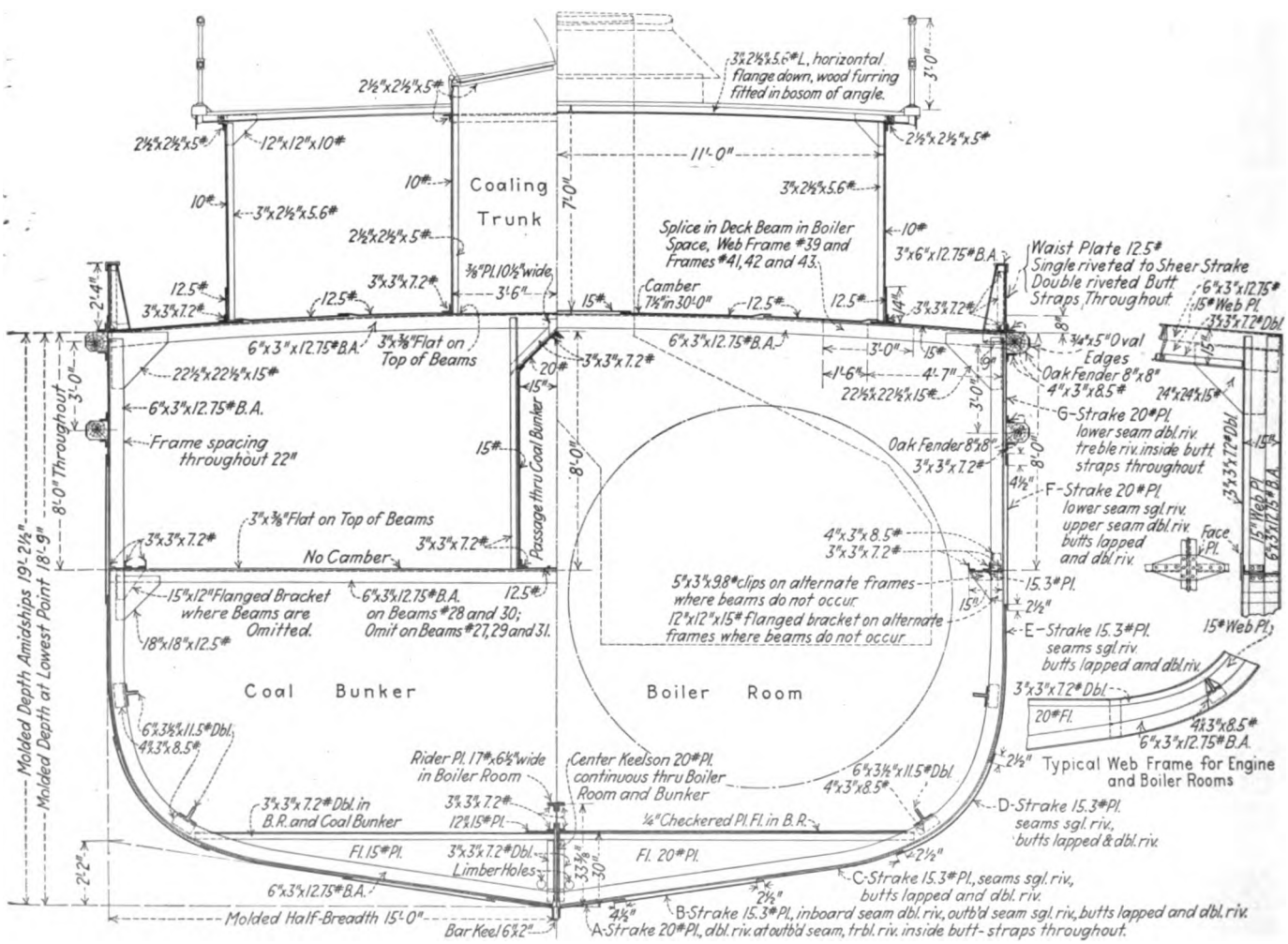
Tug Adler Ready for Launching

Taking Her Initial Dip

tight steel doors operated from the upper grating are provided in the bulkhead between the coal bunker and boiler room.

The shell and deck plate seams are single riveted except the lap of the garboard and "B" strake, the lap of the sheer and "F" strake and the laps in way of the deep tank. these being double riveted. The midship thickness of plating has been maintained throughout the vessel's length, no reduction in thickness being made at the ends.

Frames, spaced on 22 inch centers throughout, are 6-inch by 3-inch by 12.75-pound bulb angles in one piece from keel to upper deck, except in way of the deep tank where they are cut and bracketed to the tank top. From the stem aft to the deep tank intermediate ice frames of 5-inch by 3-inch by 9.8-pound angles are fitted, extending from 2 feet above the deep load line to 2 feet below the light line. The hull is further strengthened by the addition of a web frame in the boiler room and a similar arrangement in the


Coaling Trunk
Coal Bunker
Boiler Room
Passage thru Coal Bunker
No Camber
Camber 1½" in 30'-0"
Splice in Deck Beam in Boiler Space, Web Frame #39 and Frames #41, 42 and 43.
Waist Plate 12.5# Single riveted to Sheer Strake Double riveted Butt Straps Throughout
Oak Fender 8"x8"
Oak Fender 8"x16"
Frame spacing throughout 22"
Molded Depth Amidships 19'-2½"
Molded Depth at Lowest Point 18'-9"
Molded Half-Breadth 15'-0"
Bar Keel 6"x2"
Typical Web Frame for Engine and Boiler Rooms
A-Strake 20# Pl., dbl. riv. at outb'd seam, trbl. riv. inside butt-straps throughout.
B-Strake 15.3# Pl., inboard seam dbl. riv., outb'd seam sgl. riv., butts lapped and dbl. riv.
C-Strake 15.3# Pl., seams sgl. riv., butts lapped and dbl. riv.
D-Strake 15.3# Pl. seams sgl. riv., butts lapped & dbl. riv.
E-Strake 15.3# Pl. seams sgl. riv. butts lapped and dbl. riv.
F-Strake 20# Pl. lower seam sgl. riv. upper seam dbl. riv. butts lapped and dbl. riv.
G-Strake 20# Pl. lower seam dbl. riv. treble riv. inside butt straps throughout.
Face Pl.
Oval Edges
Rider Pl. 17#x6½" wide in Boiler Room
Center Keelson 20# Pl. continuous thru Boiler Room and Bunker
Limber Holes

Midship Section of Sea-Going Tug Adler

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engine room. In the coal bunker, beams are fitted on alternate frames, in line with the second deck stringer, to tie the shell together.

ACCOMMODATION

Accommodation for 12 men is provided in the 'tween decks forward of the boiler room. This space is divided into two compartments, each being fitted with steel berths, steel clothes lockers, table, benches and wash sink with running water. Ventilation is provided by air ports and two 10-inch cowls. Deck lights, set in the upper deck, aid in lighting these spaces.

Four rooms, located amidships in the deck house, provide quarters for eight men. Each room is fitted out with two berths, steel clothes lockers and wash basins with running water. These four rooms, as well as the crew's quarters forward, are finished in yellow pine painted white. The floors in all quarters are of wood, those in the four deck house rooms being calked and paved.

A galley and saloon occupy the space in the deck house forward of the boiler casing. The galley is equipped with a six-hole Shipmate range, dresser with two sinks and a refrigerator having two compartments, one for meat and the other for vegetables. A one-ton electrically driven refrigerating machine, located on the second deck, cools the ice box. The saloon joiner work is yellow pine finished natural.

The pilot house is of steel with the interior finished in oak. The captain's and spare room each have a double built-in berth with drawers under, wardrobe, wash basin with running water and upholstered seat.

Screens are fitted to all doors and ports to the accommodations.

DECK CASTINGS

The deck castings are extra heavy, of cast steel. Forward is a 12-inch double bitt and a 16-inch double bitt is located aft. Along the rail are located six 12-inch double side bitts, six 5-foot cleats and six fairleads securely fastened to the deck. At the stem a combination niggerhead, mooring ports and anchor davit step casting is located. This casting is of steel, in one piece, making a neat serviceable fitting.

RUDDER

The rudder is of the balanced type, having an area of 99 square feet, a ratio of rudder area to lateral area of hull of 0.05. The rudder frame is of cast steel, the stock at the upper bearing being 10½ inches diameter, at the lower bearing 9¾ inches, while the stock between the bearings is 8½ inches by 14 inches. The rudder is plated on both sides of its frame with 5/16-inch plating with a wood filler between.

PROPELLING MACHINERY

The vessel is driven by a three cylinder, vertical, inverted, direct acting Stephenson link, triple expansion, Hamilton engine having cylinders 18 inches by 30 inches by 48 inches with a common stroke of 33 inches. It was designed to develop 1,400 indicated horsepower at 120 revolutions per minute using steam at 180 pounds per square inch pressure, but during the trial trip the maximum indicated horsepower developed was 1,594, this being obtained at 122 revolutions per minute and with 180 pounds of steam. The engine was later linked in to obtain a more perfect balance and to limit the indicated horsepower to 1,400 with full throttle.

BOILERS

Steam is furnished at 180 pounds per square inch by two Scotch boilers, 12 feet 8 inches in diameter by 11 feet 4 inches long. The total heating surface is 3,800 square feet and the total grate surface 116 square feet. Each boiler has three 38-inch Morison furnaces fitted with shaker grates and convertible fronts for either coal or oil burning. Heated forced draft is supplied by a 66-inch fan located on a fan flat above the boilers and Diamond soot blowers are installed.

Although the vessel went into commission as a coal burner, it is a matter of but a few hours to convert her into an oil burner, the necessary equipment for making the change being carried aboard.

AUXILIARY MACHINERY

The following auxiliary machinery was fitted:

Worthington surface condenser, 2,200 square feet.
Worthington centrifugal circulating pump, 8-inch discharge, driven by a 7½-inch by 7½-inch direct connected engine.
Worthington verticle simplex, beam, air pump, 10 inches by 18 inches by 24 inches.
Worthington vertical simplex, piston pattern, boiler feed pumps, 10 inches by 6 inches by 12 inches.
Worthington horizontal duplex sanitary and evaporator feed pump, 4½ inches by 2¾ inches by 4 inches.
Worthington horizontal duplex bilge pump, 6 inches by 4 inches by 6 inches.
Worthington horizontal duplex fire and wrecking pump, 14 inches by 10¼ inches by 12 inches.
Reilly steel shell, 20-ton evaporator.
Engberg 7½ kilowatt, 110 volt, direct current generator direct connected to a 6-inch by 5-inch engine.
Reilly feed water heater, capacity 26,000 pounds per hour, from 100 degrees to 212 degrees Fahrenheit.
Reid forced draft blower and furnace fronts, fan 66 inches, driven by a 6¼-inch by 4½-inch engine.
Coen oil burning equipment: two 4½-inch by 2¾-inch by 4-inch horizontal duplex pumps, 3 heaters and strainers.
Williamson steering engine, 6 inches by 6 inches.
Forward capstan, 7-inch by 8-inch engine.
After capstan, 6-inch by 8-inch engine.

BOILER DATA AND MACHINERY WEIGHTS

Detail boiler data and machinery weights relative to the installation are as follows:

Heating surface.....2.7 square feet per indicated horsepower.
Grate area.....12 indicated horsepower per square foot of grate area.
Volume of boilers.....2.1 cubic feet per indicated horsepower.
Boiler weight (without water)..104.6 pounds per indicated horsepower of engine.
Boiler weight (without water)..38.5 pounds per square foot of heating surface.
Boiler weight (without water)..1,262 pounds per square foot of grate area.
Engine weight.....70 pounds per indicated horsepower.
Condenser cooling surface.....1.57 square feet per indicated horsepower.

	Weight, Pounds	Percent of Total
Weight of engine	98,000	31.9
Weight of boiler (without water)	146,436	47.7
Weight of condenser	14,750	4.8
Weight of circulating pump	5,500	1.8
Weight of air pump	3,800	1.2
Weight of boiler feed pumps	2,800	0.9
Weight of evaporator feed pump	325	0.1
Weight of bilge pump	640	0.2
Weight of fire and wrecking pump	4,800	1.6
Weight of evaporator	1,500	0.5
Weight of generator set	1,900	0.6
Weight of feed water heater	1,550	0.5
Weight of blower and furnace fronts	13,600	4.5
Weight of oil burning equipment	3,300	1.1
Weight of steering engine	8,000	2.6
		100.0

Total weight of main and auxiliary machinery without water in boiler.....306,901 pounds
Weight of water in boiler, etc..... 84,000 pounds

Total weight, steam up.....390,901 pounds

Weight per indicated horsepower (without water) 219 pounds
Weight per indicated horsepower, steam up..... 279 pounds

Note: The above does not include propeller, tail shaft and piping.

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The stern tube is of cast iron having a split cast iron bushing 3 feet 3 inches long in the after end. In way of this bushing the tail shaft has a series of steel rings 6 inches long shrunk on. The tube is kept full of grease by means of a large compression cup located in the steering engine room. In way of the stuffing box gland the usual bronze sleeve is fitted on the tail shaft.

A four bladed cast iron propeller 11 feet 6 inches diameter and 12 feet 6 inches pitch with a blade area of 53 square feet is fitted.

A feature of interest is the arrangement of wheels in the pilot house. On account of the wheel house being about 18 feet wide it was thought desirable to install two complete steering wheels, one on either side of the centerline. The wheels are sufficiently close to the sides of the house to allow the helmsman to lean out of the sliding window provided and still be close to the wheel. Three stands with bell and whistle pulls are provided.

The *Adler* was built by the Pensacola Shipbuilding Company, Pensacola, Fla., to the order of Morris Adler and Company, Birmingham, Ala., Morris Adler and Company being the holding company for the Corona Coal Company, of which the River and Ocean Towing Company is a subsidiary. The lines for the vessel were developed by Captain J. G. Walton of the United States Coast Guard Service, Washington, D. C., who acted as naval architect for the owners. Mr. James Brown, marine superintendent of the River and Ocean Towing Company, represented the owners at the Pensacola Shipbuilding Company's yard during the construction of the vessel.

Diesel-Electric Ferryboat, Poughkeepsie

Ice-Breaking Passenger and Vehicle Ferry for Service on the Hudson River to Have Novel Type of Hull

By C. V. S. Wyckoff*

THE ferryboat *Poughkeepsie*, now being built by the Atlantic, Gulf and Pacific Company, Mill Basin, Brooklyn, N. Y., for the Poughkeepsie and Highland Ferry Company, Poughkeepsie, N. Y., will be unique in several particulars. She will be the first commercial vessel of this type to be propelled by the Diesel-electric system and the first to be built with a "hull-fin" and on the "arconstruct" principle. Because of these features, she will have an unusually large carrying capacity and is expected to be very economical in operation.

Conditions of Service

The *Poughkeepsie* will have a length over guards of 140 feet; a beam over guards of 52 feet; a beam of hull at the waterline of 46 feet; a draft of 9 feet; a displacement of 400 tons and a speed of 12 knots. Her hull will be of steel and her superstructure of wood.

She will ply between Poughkeepsie and Highland on the Hudson River, a distance of about three-quarters of a mile. The two special conditions of her service are a heavy automobile traffic in summer and thick ice in winter.

The use of the Diesel-electric drive gives her exceptional carrying-capacity because it permits of a perfectly clear main deck without a center casing or even a stack. Consequently she will have, in addition to two passenger cabins on this deck, four driveways instead of only the two permitted on steam-propelled ferries.

What this means can be understood by comparing the *Poughkeepsie* with the new Staten Island ferry, the largest of her type in America. Though this latter boat is to be 250 feet long and will have a 66-foot beam, she will have only 440 feet of driveway and a capacity of 28 cars; whereas the *Poughkeepsie* will have 472 feet of driveway and will be able to accommodate 32 cars.

In order to operate all winter, the *Poughkeepsie* will have to contend with ice up to 3 feet thick, with occasional windrows down to the bottom of the river. She will, therefore, be very substantially built; but more especially, her hull-fin design will permit her to overcome ice conditions that would tie up a boat of the ordinary type.

As shown by the drawings, the hull of the *Poughkeepsie* is of novel design. Instead of the regular narrow hull extending to the keel, she will have a comparatively shoal hull with a "hull-fin" below. This hull-fin, which is patented by Captain Samuel Golden, Brooklyn, N. Y., has several special advantages.

The hull-fin places the propellers under the boat, where they are always immersed in solid water, instead of at the extreme ends, where the water is broken and where they can emerge in rough weather. This location, together with the shape and fine ends of the fin, greatly increases the efficiency of both propellers and also permits of the use of propeller speeds that are much higher than ordinary practice, thus increasing the efficiency of the propelling machinery.

The broad hull with the fin keel imparts a high degree of stability to the vessel owing to the breadth of the stability angles. The *Poughkeepsie* could, in fact, carry her entire load on one side without capsizing. She will also possess superior maneuvering power.

The ice-breaking features of the hull-fin design are obvious at a glance. Instead of wedging into the ice, the *Poughkeepsie* will ride over it, crush it with her weight and then push it aside, exactly as the specially-designed Russian and Swedish ice-breakers act. Then, too, her rudders and propellers are so placed as to avoid actual contact with solid ice; the propellers will act as centrifugal pumps to draw the ice fragments out from under the hull.

The depth of the *Poughkeepsie's* hull will be 10 feet, its draft 3½ feet and that of the hull-fin 5½ feet.

While the hull-fin admittedly adds to the cost of a given hull, its superior efficiency reduces the operating cost. In addition, this extra cost is compensated for in the *Poughkeepsie* by the use of the arconstruct system patented by Frank Nichols, of New York.

In the arconstruct system of design and construction all the relative transverse sections are arcs of the same radii. In other words, every transverse curve in the hull, whether in the bottom, bilge or side, is a relatively longer or shorter arc of the same circle.

This simplification of the lines greatly reduces the cost of the mold loft, fabrication and plating work and also increases the strength of the hull. Moreover, since the same arc is always presented to the water, the water when once

*Naval architect, sole licensee of combined "arconstruct" and "hull-fin" designs, New York and San Diego.

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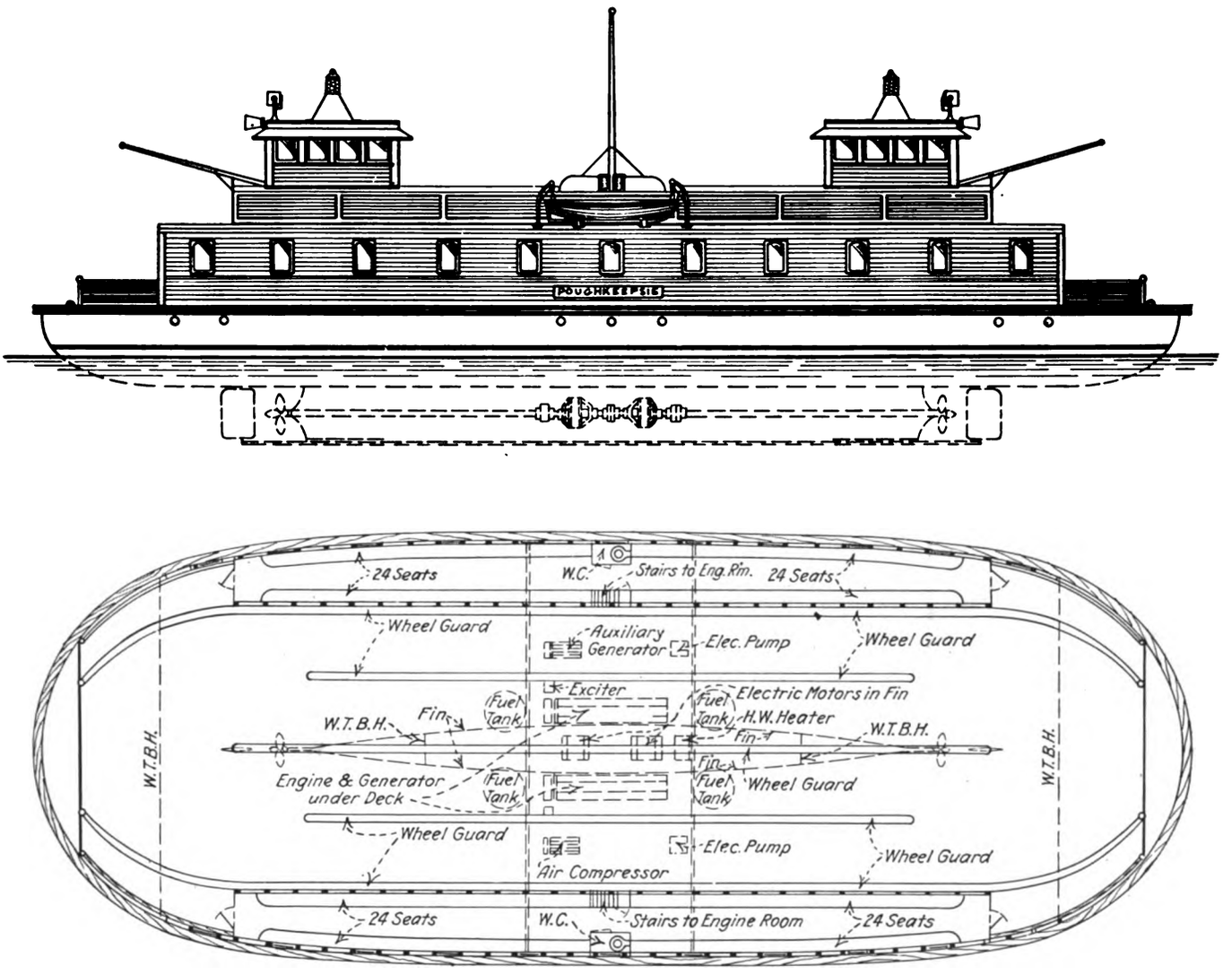


Profile and Deck Plan of Ferryboat Poughkeepsie

disturbed follows the hull freely without further disturbance, the usual resistance of increasing area, and thus the ship efficiency is still further increased.

DIESEL-ELECTRIC PROPULSION

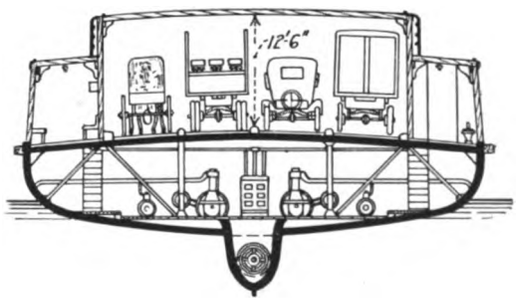
The use of the Diesel-electric system of propulsion is in accord with the best marine engineering practice for this class of vessel. The high economy and unparalleled maneuvering power of this drive are too well known to require discussion here.

There will be propeller controls in the pilot houses and in the engine room and the pilot can directly and instantly control every movement of the boat. The fact that the *Poughkeepsie* will be able to accelerate to full speed in minimum time, come to a full stop from full speed in a few seconds and reverse her motion in less time than is possible with steam drive will not only improve her schedules but will decrease the possibilities of collision or damage when entering the slip. She is, in fact, expected to make regularly three trips per hour, instead of the two trips made by the present ferryboat.

For her main engines two 150-horsepower six-cylinder Winton Diesel engines of 450 revolutions per minute, each driving a 90 kilowatt Westinghouse generator, have been specified.

Her propellers, which are to be normally rigidly connected together, will be driven, according to specifications, by two 100-horsepower motors. Either or both engines, and either or both propeller motors, can be used at any time. The engine room will be located in the *Poughkeepsie's* hull and the propeller motors and shafting in the hull-fin.

The propellers will operate with full power at the unusually high speed of 600 revolutions per minute, but their location at the ends of the hull-fin makes this possible without cavitation or excessive slip. The propellers will be of the standard 3-blade design, 48 inches in diameter and 28 inches pitch.



Section Through Machinery Space

It is expected that the *Poughkeepsie* will be in operation by next spring.

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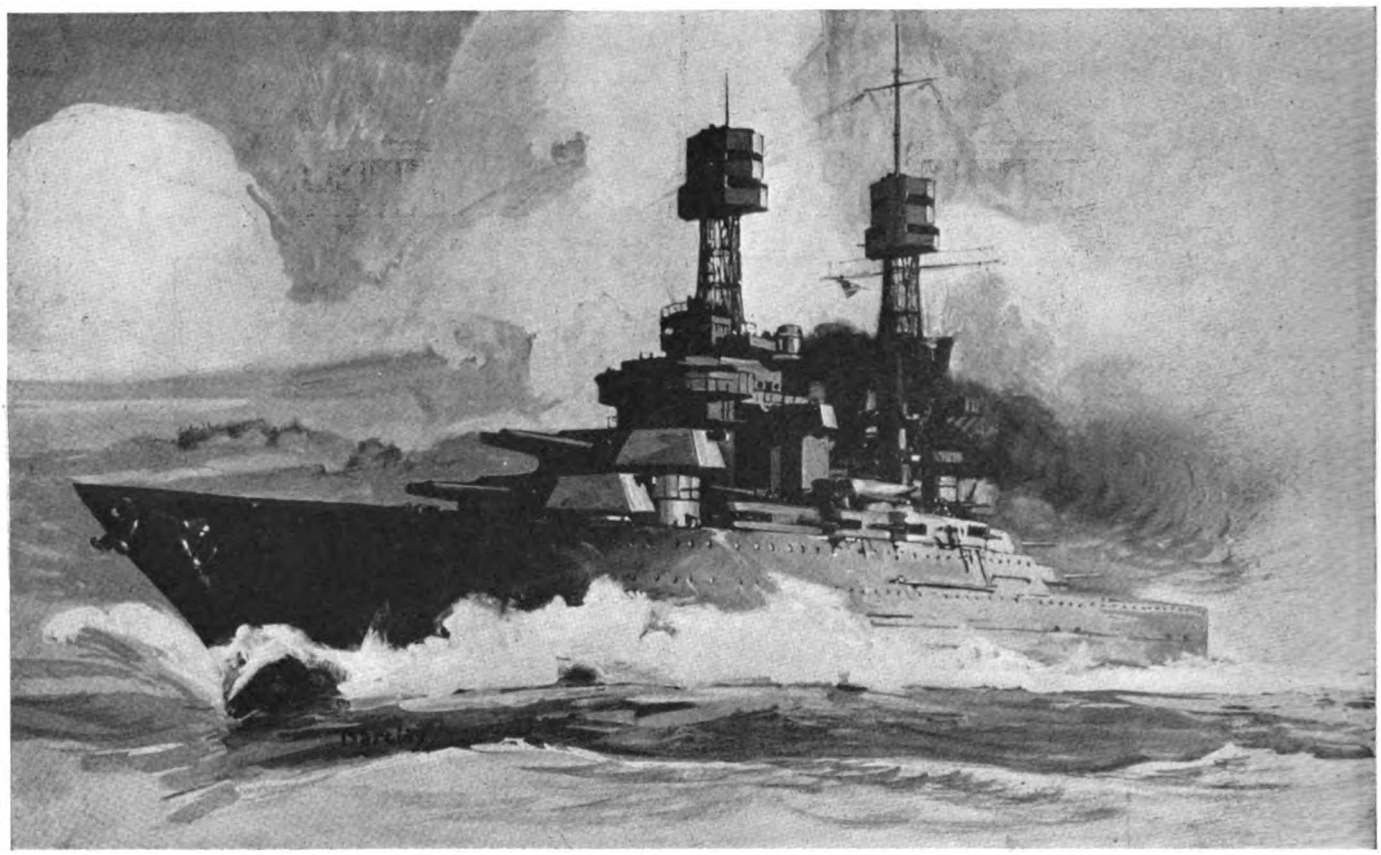

Artist's Sketch of the Battleship Washington as She Will Look When Completed

Battleship Washington Launched at Camden

32,000-Ton Superdreadnought Christened by Ten-Year-Old Daughter of Congressman Summers—Details of the Vessel

WITH a launching weight of 16,800 tons the United States battleship *Washington* was sent down the ways at the yards of the New York Shipbuilding Corporation, Camden, N. J., for her initial dip on September 1. As the vessel started down the ways Miss Jean Summers, the ten-year-old daughter of Representative and Mrs. J. W. Summers of Walla Walla, Wash., broke a bottle of champagne against the bow and officially named the vessel the *Washington*.

The new battleship is a sister ship of the *Colorado* which was launched from an adjacent way at the same yard last March. Although authorized in 1916 and contracted for in January, 1917, construction of these two superdreadnoughts of the most powerful type afloat was not begun until the spring of 1919 as the Navy Department purposely deferred its capital ship program during the war so that all available shipbuilding capacity could be concentrated on the construction of troop and supply ships and torpedo boat destroyers to meet the immediate emergency.

The main dimensions of the vessel are as follows:

Length overall	624 feet 6 inches
Length, on waterline	600 feet 0 inches
Breadth, extreme	97 feet 5¾ inches
Depth, to main deck	47 feet 2 inches
Draft, normal	30 feet 6 inches
Displacement, normal load	about 32,600 tons
Displacement, full load	about 33,600 tons

Like all recent United States capital ships, the *Washington* will be electrically propelled. Her main engines will consist of two 15,000 horsepower Westinghouse turbo electric generators, which will generate electricity to operate four 8,300 horsepower Westinghouse motors, one for each propeller. The steam will be generated by eight watertube boilers fired by oil.

Armament

The main battery of the vessel will consist of eight 16-inch, 45 calibre breech-loading rifles, mounted in four turrets, two forward and two aft. The secondary battery will consist of fourteen 5-inch rapid fire guns placed in advantageous positions. For protection against hostile gun-fire from enemy ships all vital parts of the vessel will be adequately protected by heavy armor. This will be arranged in accordance with the best American practice.

All four turrets in which the main battery is mounted, as well as the barbettes, which contain the mechanism for turning the turrets and their guns in any desired direction, are entirely encased in heavy steel armor.

Subdivision of Hull

Probably almost as important as the armor itself, from the standpoint of protection against gun fire and torpedo attack, is the watertight subdivision of the hull. The portion of the vessel above the splinter deck, which is practically at the load waterline, is very well subdivided by watertight bulkheads, but below this deck the vessel is divided into a multitude of comparatively small watertight compartments. This is accomplished by closely spaced transverse

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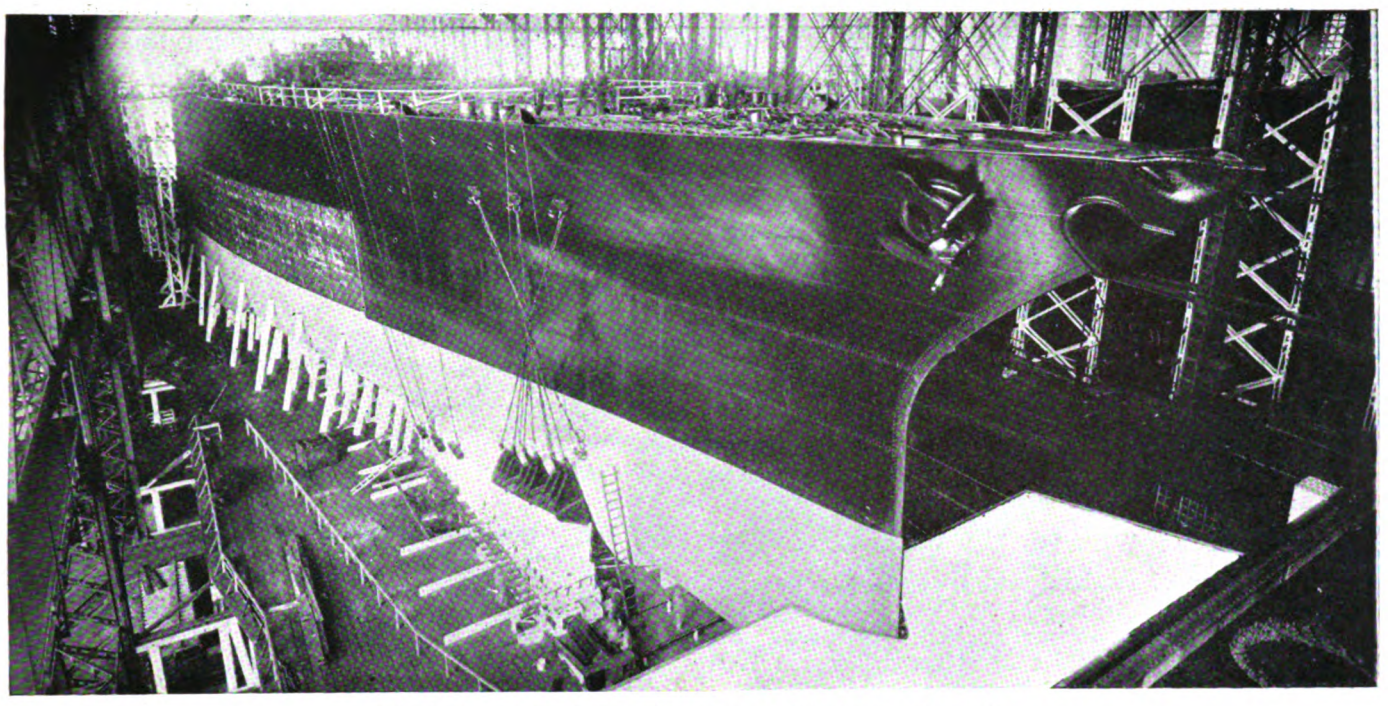
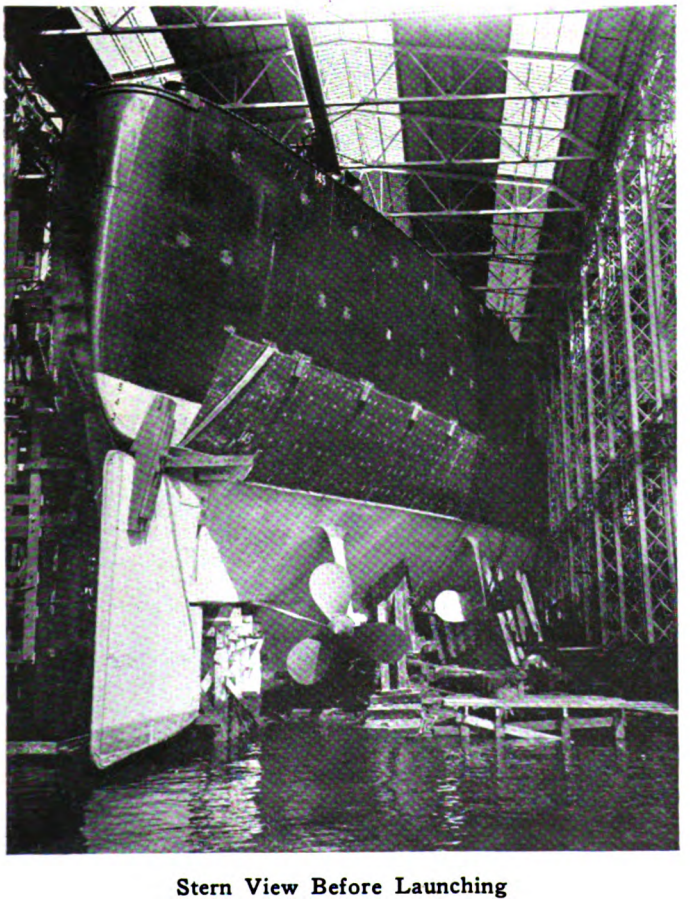


United States Battleship Washington Ready for Launching

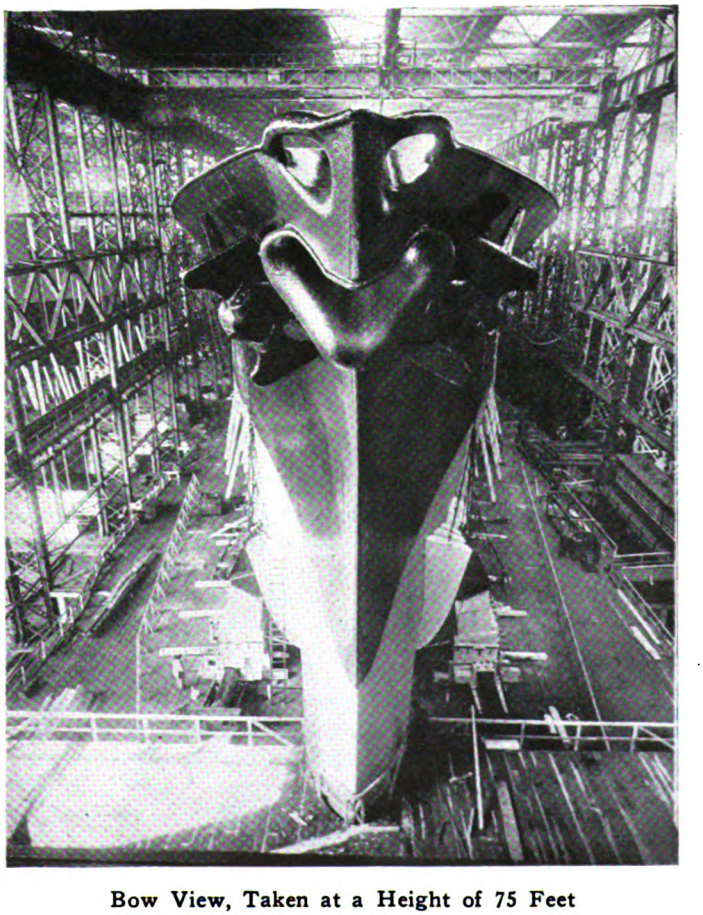
bulkheads throughout the length of the ship and several watertight longitudinal bulkheads.

Each of the eight watertube boilers is in a separate watertight compartment, as is also each of the two turbo generators which generate the electrical energy for the operation of the main propelling motors. The four main propelling motors are located in three watertight compartments. With this subdivision, even if torpedo damage should penetrate into the portion of the vessel occupied by the propelling machinery, the vessel would not be put out of commission, since the simultaneous flooding of one or more of the boiler compartments, one turbo generator compartment and one or more propelling motor compartments would neither sink the vessel nor render it unnavigable.

To operate the vessel a complement of 46 commissioned officers, 12 warrant officers and 1,022 enlisted men, includ-



Stern View Before Launching



Bow View, Taken at a Height of 75 Feet

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ing 71 marines, will be carried. Accommodations for commissioned and warrant officers will be located aft on the second and third decks. The crew's quarters will be forward and amidships on the main deck and second decks.

Pronounced Flare of Bow

In general appearance the *Washington* will resemble the other capital ships recently added to our Navy. Forward her shell will have a very pronounced flare outward from the waterline to the upper deck. This flare, carried undiminished forward, naturally results in the vessel's clipper stem, intended to facilitate the stowing and handling of her anchors, of which there will be three. The pronounced flare also makes possible a roomy deck in spite of the very fine waterline forward. The upper deck is the weather deck from the stem to abaft amidships. Here the main deck, next below the upper deck, becomes the weather deck and extends as such to the stern. The stern is of the cruiser type, now common to most large war vessels.

Comparison With the Old Washington

The launching of the battleship *Washington* comes just fifteen years after the delivery by the New York Shipbuilding Corporation of the armored cruiser *Washington*, since renamed the *Seattle*. At the time of her delivery in 1906 the old *Washington* was the last word in naval construction and her size and armament, given below, form an interesting comparison with present day developments:

Length, overall	504 feet 5½ inches
Length, on load waterline	502 feet 0 inches
Breadth	72 feet10½ inches
Depth	42 feet 2¼ inches
Draft, normal	25 feet 0 inches
Displacement, normal load	14,500 tons
Fuel	Coal

The battery of this vessel consists of four 10-inch 45-calibre breech-loading rifles, sixteen 6-inch, 50-calibre, rapid-fire guns, and twenty-two 3-inch, 50-calibre, rapid-fire guns.

Between the delivery of the first *Washington* and the launching of the battleship of this name, the New York Shipbuilding Corporation has built for the United States Navy seven battleships, forty torpedo boat destroyers and a destroyer tender, and now has under construction the battleships *Colorado* and *Washington* and the battle cruiser *Saratoga*.

Close Quarter Deck Planing Machine

SWAN, Hunter and Wigham Richardson, Limited, have overcome the custom of planing by hand those portions of a ship's deck which cannot be planed by the ordinary center planing machine by using a close quarter planing machine electrically or otherwise operated. The device consists of a rotor which carries knives of special design around its circumference which is attached to the motor direct; the position of this rotor is on the extreme outside of the wagon or trolley carrying the motor and can be arranged or built for either hand. The device when applied will cut right up to within a half inch of any casing or deck houses, thus eliminating a great deal of hand work. With a device as described carrying several toothed cutters and several finishing cutters, the arrangement is such that the planing machine can be made self-propelling, the operator guiding same only.

A braking device is also employed to stop the cutter at the completion of a trip. For working between ships' frames a special device is employed, the cutter working in a vertical position or as otherwise may be required.

The cutters or knives are so arranged on the rotor that they cannot get adrift as is the practice with cutters or blades bolted down. The dovetailed principle of cutter employed in conjunction with the keeping rings removes the possibility of the knives working loose.

A spare rotor may be employed, thus always having in hand a newly ground set of blades, the whole of which can be ground without removing them from position.

The parts are shown in Fig. 1, designated as follows: (a) motor, (b) rotor, (c) section of blade, (d) keeping rings,

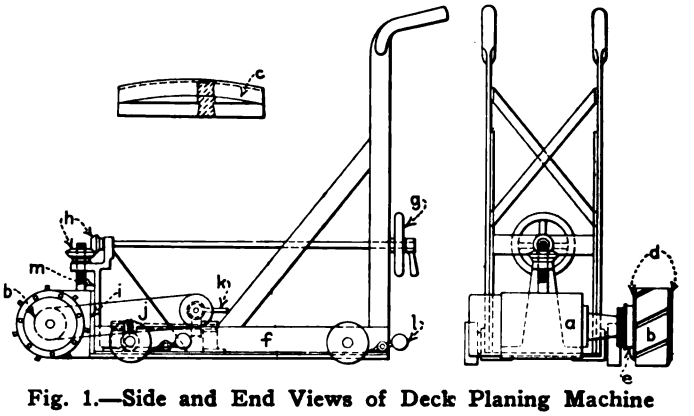

Fig. 1.—Side and End Views of Deck Planing Machine

(e) brake block, (f) wagon or trolley, (g) regulating wheel, (h) gear wheels, (i) base plate for motor (a), (k) clutch for operating gear for propelling the planes, (1) scrapers for wheels, and (m) bracket carrying gears.

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Looking Aft from the Forecastle of the United States Battleship California, Showing the Forward Turrets and Fighting Structure

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Are You a Marine Engineer, Edison Standard?

Answers to the One Hundred Questions Published in August That Thomas Edison Might Ask Marine Engineers

By "Old Scotch"

THE 100 questions which I propounded, a la Edison, in the August number have, as I feared, proved a boomerang inasmuch as there has been an insistent demand from many of the readers for me to answer them myself. I think I stated that I did not guarantee that I could answer them all, on the basis that any one can ask questions which ten wise men could not answer. Without any pretense of being even *one* wise man I have made the following attempt, which until proved otherwise, can be accepted as reasonably accurate.

There are several of these answers which admittedly are controversial, and others which might be better expressed than they are. The object was to make them as simple and easily understood as possible.

1. Who built the first triple-expansion engine in this country?

The Bath Iron Works, Bath, Me. It was designed by Mr. Charles E. Hyde.

2. About what year was it installed and in what vessel?

About 1883, and it was installed in the steam yacht *Meteor,* a turtle-backed vessel originally designed to cross the Atlantic in four days.

3. Were marine boilers ever made of other material than iron or steel?

Yes.

4. If so, what material or materials were used?

Copper was used for many naval boilers.

5. Name one large American passenger vessel which used a compound oscillating engine within the past thirty-five years.

The *Connecticut* of the old Stonington Line of Sound steamers, built in 1888.

6. What is the largest American passenger vessel?

The *Leviathan.*

7. What is the largest American freight vessel?

The *Lewis Luckenbach* of 14,000 deadweight tons.

8. What is the largest horsepower used in any American-built vessel?

For American-built merchant vessels, 25,000. Naval vessels having 160,000 horsepower are now building.

9. What is the largest side-wheel steamer now in use in this country?

The Seeandbee on the Great Lakes is longer, beamier and has a greater tonnage than the *Commonwealth,* popularly supposed to be the largest side-wheeler in this country.

10-11. Has any steamer ever been built in this country which used neither screw nor paddle wheels for propulsion? If so, what method of propulsion was adopted?

Yes, a small yacht named *Evolution,* facetiously called the "squirt boat," which was propelled by two jets of water from ¾-inch nozzles, under great pressure.

12. Who invented the screw propeller?

John Ericsson is reputed to be the inventor, but many authorities give the credit to Mr. Stevens of Hoboken, N. J.

13. What vessel was known while under construction as the "dynamite gunboat"?

The *Vesuvius.*

14. What is the largest tugboat in the United States?

The *Conestoga,* 170 feet long overall and 1,200 tons displacement.

15. What is a hydrokineter and for what purpose is it used?

A hydrokineter is, as its name implies, an apparatus for heating water, and it is used to heat and circulate the water in Scotch boilers.

16. Why is bituminous coal used on steamships instead of anthracite?

Because it is cheaper, more volatile and better for steaming purposes. It is also more easy to obtain in all parts of the world.

17. What is cavitation and how is it caused?

"Cavitation" is, simply expressed, a hole in the water in which the propeller revolves, caused by the centrifugal force due to excessive revolutions, which prevents the screw from operating in "solid water."

18. How is the horsepower of a reduction geared turbine determined?

By a torsion-meter.

19. How is the horsepower of a Diesel engine ascertained?

By indicators with heavy springs.

20. What is CO_2?

Carbon dioxide; a product of good combustion.

21. What is the ideal percentage of CO_2 for efficient combustion?

About 14½ percent.

22. What is "slip" and how is it determined?

"Slip" is the difference between the distance a vessel is actually propelled through the water and the distance obtained by multiplying the pitch of the screw by the number of revolutions. It is usually expressed in percentage.

23. What is forced lubrication, as applied to marine engines?

"Forced" lubrication is, as its name implies, the forcing of oil to the bearings, either by gravity or by special pumps. It insures constant oiling of important bearings and eliminates the danger of insufficient lubrication when hand methods are used.

24. Does a triple expansion engine always have three cylinders?

Not necessarily, as frequently four cylinders are used and sometimes five.

25. How many barrels of ordinary fuel oil are equivalent in steaming value to a ton of ordinary bituminous coal?

About 2.8 barrels of oil should be equivalent to 1 ton (2,240 pounds) of steaming coal.

26. What are the purposes of a deep tank on a freight vessel?

The primary purpose is to carry water ballast when the ship is light and to raise the center of gravity of the ballast carried, to insure easier rolling in a seaway. At times it is used to carry liquid cargoes or oil fuel.

27. What is the mechanical equivalent of a heat unit?

Seven hundred and seventy-eight foot-pounds of energy, known as Joule's equivalent.

28. What other material than wrought iron or wrought steel is sometimes used for anchor chains?

Cast steel is now used successfully.

29. Who produced the first successful marine steam turbine?

Sir Charles Parsons.

30. How many cubic feet are there to a ton of bituminous coal?

Forty-two, generally adopted.

31. What is the temperature of steam corresponding to a gage pressure of 200 pounds per square inch?

381.7 degrees F.

32. What is the generally adopted diameter of condenser tubes?

Five-eighths inch outside diameter is most generally used and occasionally ¾ inch.

33. What type of condenser is almost universally used on Great Lakes steamers?

The jet condenser, where the cooling water mixes with the condensate.

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34. What is meant by a triple effect evaporator?

Where three evaporators are used and the generated steam of No. 1 is used to generate steam in No. 2 and the steam generated in No. 2 is used to generate steam in No. 3.

35. How would you determine whether or not distilled water contained salt?

The simplest method is to add a few drops of nitrate of silver to a glassful of the distilled water. If any chlorine is present the water will become clouded by the chemical reaction.

36. What is meant by 28 inches of vacuum?

By 28 inches of vacuum is meant that all air is excluded from the container except an amount equivalent to the difference between 30 and 28. The weight of the atmosphere at sea level is assumed to be equivalent, per square inch, to the weight of a column of mercury 30 inches high. Hence 28 inches of vacuum means all air removed except an amount, per square inch, equal in weight to a column of mercury 2 inches high. In reality a cubic inch of mercury at 60 degrees temperature weighs 0.49 pound and the atmospheric pressure is therefore 14.723 pounds per square inch. A perfect vacuum is therefore 29.44 inches.

37. What is meant by 2½ inches of air pressure in a fireroom?

The height in inches shown in a U-tube containing water, one end of which is connected to the space under pressure and the other end to the atmosphere.

38. What is a single acting engine?

An engine which receives propulsive impetus on one side of the piston only.

39. What is an average temperature at the bottom of the smokestack?

About 600 degrees F.

40. Were geared marine engines ever used before 1900?

Yes.

41. If so, wherein did they very materially differ from present types of geared turbines?

In Civil War days certain vessels were fitted with engines "geared up," whereas all modern marine geared engines are "geared down." In other words, the first type drove the propeller at a greater number of revolutions than the engine, while with present types the propeller runs at much less revolutions than the engine.

42. What was the name of the first steam vessel which crossed the Atlantic?

The *Savannah*.

43. What firm, now in existence, built the original *Monitor*?

Continental Iron Works, Greenpoint, N. Y.

44. Name an American educational institution entirely devoted to naval architecture and marine engineering.

Webb Academy at Fordham Heights, N. Y.

45. Who is the present head of the Steamboat Inspection Service and what is his official title?

George Uhler, Supervising Inspector General.

46. Name three well known manufacturers of marine pumps.

Worthington, Davidson, Bethlehem.

47. What is a pneumercator, and what is its purpose?

An instrument for indicating the height of liquids in tanks: they can be placed in any part of the ship and give accurate relative heights. They are also used to indicate the draft of the vessel.

48. How many members are there to the Shipping Board?

Seven (7).

49. What is a "red ink" license, and why are they so called?

A "red ink" license is a United States Steamboat Inspection license granted to alien officers on account of war conditions: so-called because the regulations required a notation on the license written in red ink.

50. What department of the Government has jurisdiction over the Lighthouse Service?

Department of Commerce.

51. How much toll will have to be paid by a 5,000 net tonnage freighter going through the Panama Canal, loaded?

$1.25 per net registered ton, hence the toll will be $6,250.

52. How are the living quarters on a motorship heated?

Either by steam from a donkey boiler or by electric heaters.

53. Is there any patent on a Diesel engine?

No, the original patent taken out by Dr. Diesel has long since expired.

54. What is the origin of the term "starboard"?

The right hand side of a vessel looking forward. From the Saxon word, "steoran," to steer, and "bord," a plank or board. In ancient galleys the craft was steered by a steerboard on the right hand quarter.

55. For what is a clinometer used on shipboard?

To measure the heel of a ship, or how far to either side of a vertical line the ship may be inclined to port or starboard.

56. State Simpson's rule.

Simpson's rule is used to determine the area of an irregular figure such as the plane of a waterline or an indicator card. The rule is to divide the base into any number of equal parts which will give an odd number of points of division. Measure the lengths of these perpendiculars or ordinates, and to the sum of the lengths of the first and last ordinates add four times the sum of the lengths of all the even numbered ordinates and twice the sum of the odd. Multiply their sum by one-third of the distance between the ordinates and the product will give the area required.

57. What is a planimeter?

An instrument for measuring the area of any irregular figure, such as an indicator card, etc.

58. For what length of time is a marine engineer's license good?

Five years.

59 What is the "deadweight" tonnage of a ship?

Deadweight capacity of a ship is the weight of cargo she can carry to her summer loadline, and generally includes bunker coal, water in boilers and weight of crew. It is approximately 64 percent of the ship's displacement.

60. What materials should be used for suction pipes in bilges?

Wrought iron, preferably galvanized.

61. What is the approximate area of smokestack in proportion to the grate surface?

About one-sixth the total grate area.

62. Why should the use of cylinder oil be restricted to a minimum?

On account of its bad effect on the boilers, as it becomes mixed with the feed water in the condenser.

63. From what is the term "monkey" wrench derived?

Said to be from its inventor, an Englishman named Munckey.

64. How many cubic inches are there in a gallon of oil?

Two hundred and thirty-one.

65. Why should not alternating current be used for the lighting set?

Alternating current is more liable to grounds and liable to start fires, hence nearly all current for lighting purposes on board ship is direct current.

66. What is the average percentage of electrical loss between generator and motor in an electrically driven ship?

About five percent.

67. What are the proper proportions of glycerine and water in a hydraulic telemotor steering gear system? Why is glycerine used?

About 30 percent glycerine and 70 percent water. The principal reason for its use is to prevent freezing.

68. What is a fair steam consumption per horsepower for a turbine reduction main drive?

About eleven pounds.

69. What material is mostly used to line stern bearings?

Lignum vitæ is almost universally used.

70. Name four of the principal American manufacturers of turbine reduction marine engines.

De Laval, General Electric, Westinghouse and Kerr.

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71. Who was the inventor of the most generally used bilge suction strainer?

The late Chief Engineer Macomb of the United States Navy.

72. What is the principle on which an ordinary pyrometer works?

The difference in expansion between two metals.

73. What is the correct position to place a draft gage in a forced draft system?

In front of the ashpit.

74. What should be the maximum chlorine contents of feed water for watertube boilers?

Not to exceed 50 grains per gallon.

75. The same for Scotch boilers?

As high as 100 grains can be used safely, but it should be kept much lower.

76. How should a steam deck winch be safeguarded in freezing weather?

Carefully drained of all water, to prevent damage from freezing.

77. Name three principal causes of excessive sparking of brushes on a marine generator?

Hard spots in brushes, roughness of the commutator and brushes improperly placed.

78. If three water gage glasses on a marine boiler should break within an hour, what would you think caused it?

The fittings would most likely be out of line.

79. Why is zinc used in a boiler?

To prevent excessive corrosion and pitting.

80. When should zinc plates be used around the stern post and rudder post?

When the material from which the propeller is cast is other than iron or steel.

81. Why are load lines fixed for sea-going vessels?

To prevent unsafe loading of vessels.

82. What elements should be considered in certifying to the amount of fuel oil received, if the contract is by the barrel, and payments are to be made by the ton?

Temperature and specific gravity.

83. What causes spontaneous combustion in a ship's bunkers?

Moisture, iron pyrites in the coal and improper ventilation.

84. What materials are generally used to filter feed water for marine boilers?

Loofas, sponges, old bagging and excelsior.

85. What precautions should be taken before sending a man into a tank which has contained fuel oil?

It should be thoroughly steamed out, have air blown through it and the air satisfactorily tested before a man enters.

86. What superiority has a Diesel engine over a steam engine for marine propulsion?

Greater fuel economy, less space occupied and fewer attendants.

87. Wherein does a steam siren differ from an ordinary whistle?

In an ordinary whistle the steam is blown direct into the bell, and gives forth a uniform tone. In a siren the flow of steam is varied by a rotating disk or other device to give a variation of sound, regulated by the speed of the disk.

88. What is cop waste?

Cotton thread which becomes hopelessly tangled or snarled on the spindles.

89. What treatment is best for bad steam burns?

Carron oil composed of an emulsion of lime and linseed oil, or any other substance which will exclude contact with the air and not further injure the burned flesh or skin.

90. What is meant by a "feathering" paddle wheel?

"Feathering" paddle wheels are those wherein the buckets or blades enter and leave the water normal to its surface. They are actuated by eccentrics on the shaft.

91. How are steam gages tested for accuracy?

Steam gages should be tested by comparison with standard gages. A much better method is to test by a gage testing machine, which through a U-tube compares the markings on the gage with actual weights.

92. What is the difference between a tube and a pipe?

The essential difference is that all pipes are based on gas pipe sizes, while tubes are usually of an outside diameter equal to the size by which they are designated. For example, a 1-inch pipe is actually 1.31 inches outside diameter, 1.05 inches inside diameter, and a 1-inch tube is actually 1 inch outside diameter, and the inside diameter varies in accordance with the thickness of the metal used.

93. What is a dynamometer?

A dynamometer is an apparatus used to determine the work performed by any motor or machine.

94. Will a gasoline engine work in a motorboat without a clutch?

Yes, for engines of small power.

95. For what purpose is a devil's claw used on board ship?

A "devil's claw" is used by firemen for breaking up and hauling out clinkers and otherwise for manipulating soft coal fires.

96. Who is the president of the American Society of Naval Architects and Marine Engineers?

Rear Admiral W. L. Capps, U. S. N.

97. Name three prominent marine papers published in the United States.

MARINE ENGINEERING AND SHIPPING AGE, *Marine Journal* and *Pacific Marine Review.*

98. What is the leading treatise on marine engineering published in America?

Dyson's "Practical Marine Engineering" is about the best treatise on the subject.

99. What is the Naperian logarithm?

A Naperian or hyperbolic logarithm is one whose base is 2.718281. The so-called common logarithm is one the base of which is 10. The Naperian log is equal to the common log $\times$ 2.302585.

100. Give ten good reasons why marine engineers have to know more than locomotive engineers. Name one hundred if you like.

While a hundred good reasons could be written the following only is necessary. A real marine engineer is a man who can operate his machinery continuously for periods of 30 days, if necessary, away from all outside help, make all repairs, and must combine skill as a machinist, boiler maker, pattern maker, plumber, steam fitter, coppersmith, electrician, etc. Most locomotive engineers are merely starters and stoppers.

Evaporator Designed to Supply Small Quantities of Distilled Water

Evaporator Set

A SMALL evaporator set having a capacity of from 15 to 30 gallons of distilled water an hour depending upon the steam pressure available is being supplied by the Griscom-Russell Company, New York. The set consists of an evaporator of the "Reilly" type containing coils of brass tubing to which steam is supplied. The vapor from this evaporator passes to a distiller and is condensed in the coils of this unit by water which circulates through the shell. If the distilled water is to be used for drinking purposes it is passed through an aerating filter, but if for laboratory or manufacturing uses, the filter is omitted from the set. The complete set is mounted on an angle iron frame, as shown in the accompanying illustration, and is ready for the steam and water connections. The height of the set ready for installation is 7 feet and its width 2 feet 4 inches.

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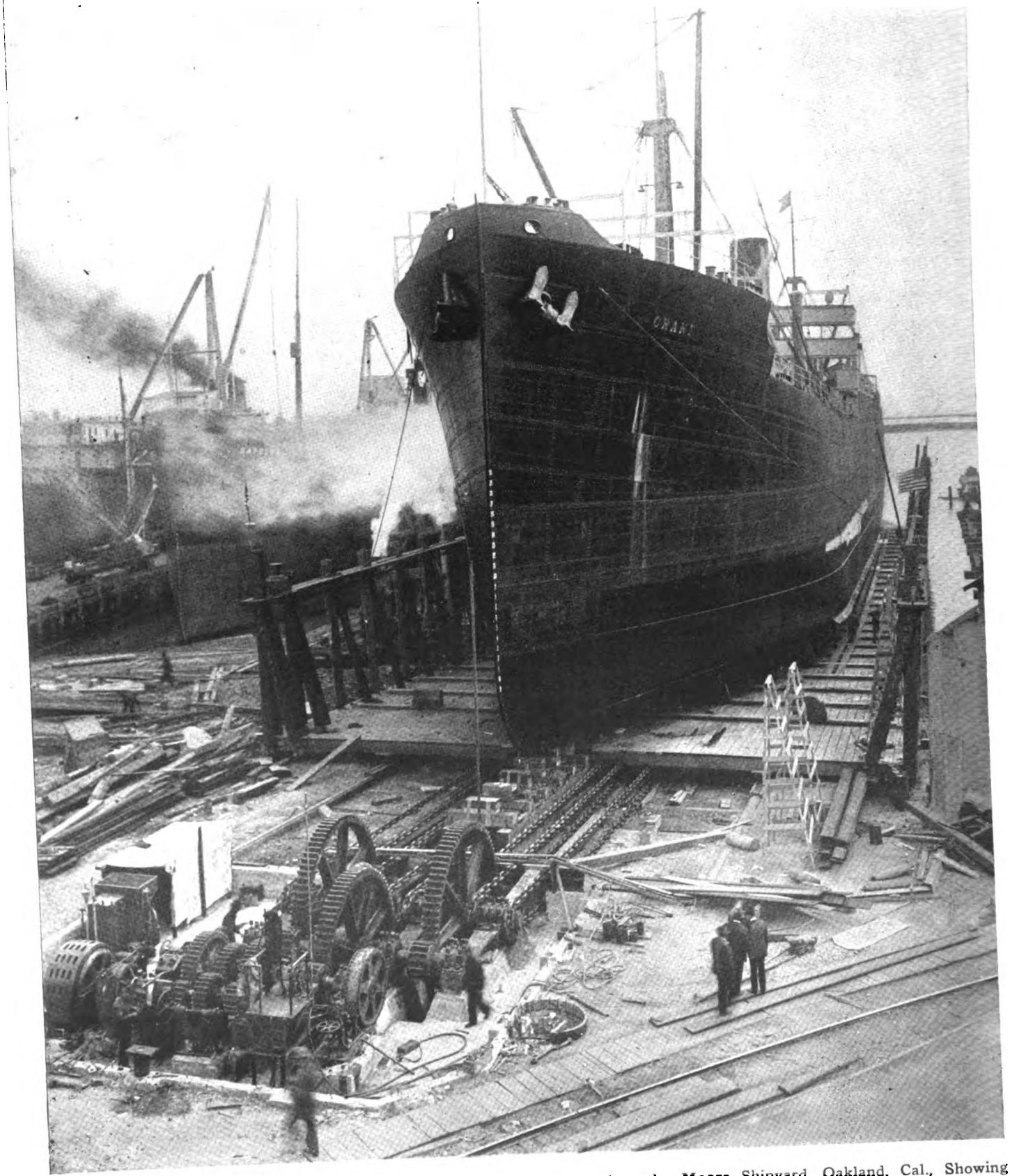

Fig. 1.—View of Railway Dry Dock No. 2 Lifting the Steamship Orani at the Moore Shipyard, Oakland, Cal., Showing the Hoisting Machinery, Chains and Roller Tracks by Means of Which the Dock Is Operated

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Railway Dry Docks at the Moore Shipyard

Anticipating an extensive demand for ship repairing facilities and to supplement and partially supersede a wartime shipbuilding program, the Moore Shipbuilding Company of Oakland, Cal., has recently added to its equipment a number of dry docks designed and built under the direction of Leland S. Rosener, consulting engineer, San Francisco, Cal. Among these are two railway dry docks, each capable of handling vessels of from 15,000 to 20,000 *deadweight tons, which are the largest docks of the type in the world.*

IN addition to two floating dry docks, each with a capacity for lifting ships weighing 12,000 long tons or of from 25,000 to 30,000 tons deadweight capacity, so arranged that they can be combined into a single dock having a capacity for ships weighing up to 21,000 long tons (700 feet in length), the Moore Shipbuilding Company, Oakland, Cal., has added to its equipment three dry docks of the railway type. One of these, an old one, was rebuilt in 1919 to give it a capacity for ships weighing 5,200 long tons. At that time this was the largest dock of its kind in the world. In 1920 two larger docks of the same type were built side by side, one with a capacity for lifting ships weighing 7,500 long tons and the other for ships weighing 8,000 long tons. Accommodating, as they do, ships up to 500 feet in length with a deadweight capacity of from 15,000 to 20,000 tons, the new docks are capable of handling the majority of ocean-going cargo ships and tankers comprising the majority of the American merchant marine, even with a partial cargo or fuel supply on board.

General Arrangement

Such docks are of comparatively low initial cost and can be built quickly as compared with docks of other types. Adding to this feature the fact that they can be operated cheaply and quickly makes them especially useful to ship repairing concerns. The average time for docking a ship is about 40 minutes from the time the ship enters the dock. In one instance three ships were docked on these three railways by one crew on a single tide.

Fig. 3 shows the general arrangement of one of the marine railways. Each dock consists of a cradle approximately 500 feet long and 76 feet wide, an inclined track system upon which the cradle moves from its point of maximum submersion to a point above the high water line and a hauling system consisting of a set of chains operated by an electrically driven hoisting mechanism. Each of these new docks is hauled by eight chains arranged in parallel and automatically equalized. The chains are made of refined iron, hand-welded and thoroughly proof tested at the factory. Fig. 1 gives a good view of the chain and hoist arrangement, the photograph having been taken before the erection of the power house. The tracks and roller trains under the ends of the cradle may also be seen.

Hoisting Machinery

The hoists were built in the Moore Shipbuilding Company's shops from Mr. Rosener's design. They are driven by 500 horsepower slip ring 450 revolutions per minute motors controlled by liquid rheostats and magnetic control. The electric equipment was supplied by the General Electric Company, Schenectady, N. Y. Speed reduction from the motors to the main-head shafts, on which the chain wildcats are mounted, is made through three sets of spur gears. All of the gears are of steel, the fast train of motor reduction gears being cut and the other slower trains being cast gears. When lowering a ship regenerative braking is used, that is, the main motor being driven overspeed returns energy to the line. This practically eliminates the use of the hand operated post brakes and the air operated band brakes, these being used only at the instant of stopping or in an emergency. A

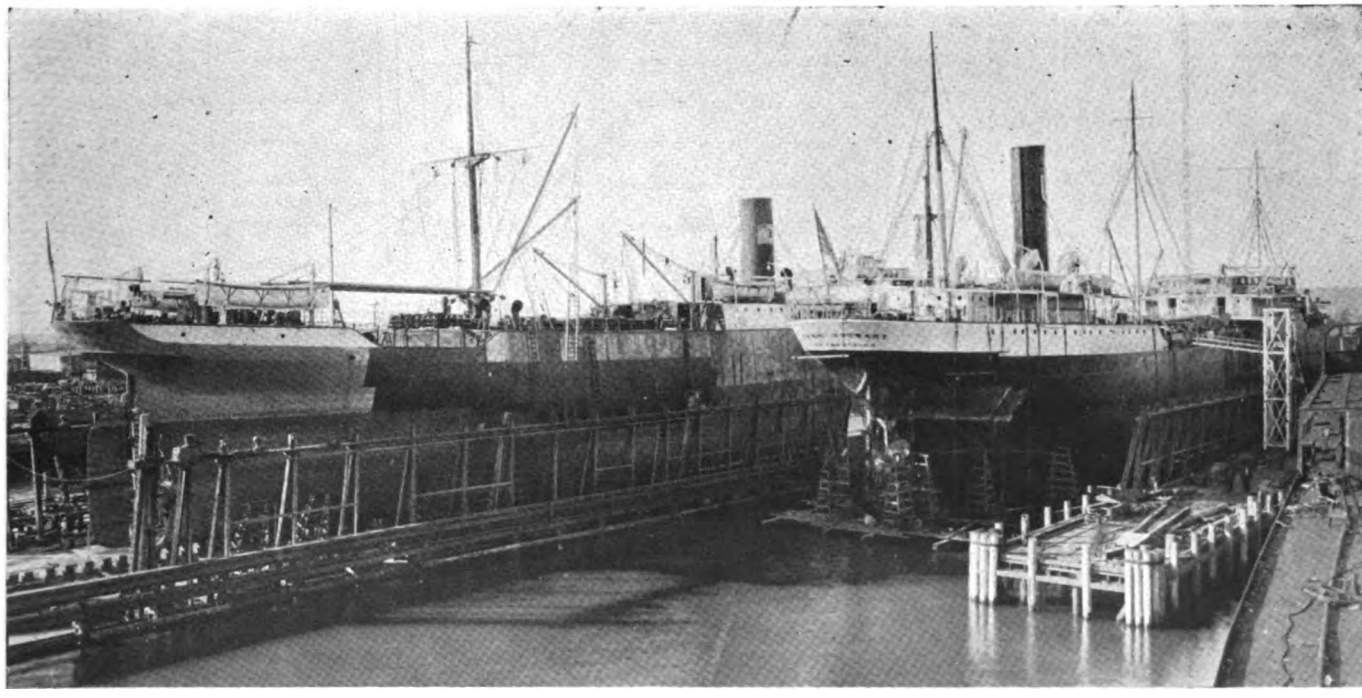

Fig. 2.—Vessels Hauled Out for Repairs on Railway Dry Docks at Moore Shipyard. Between the Docks Can Be Seen the 4-Wire Trolley System

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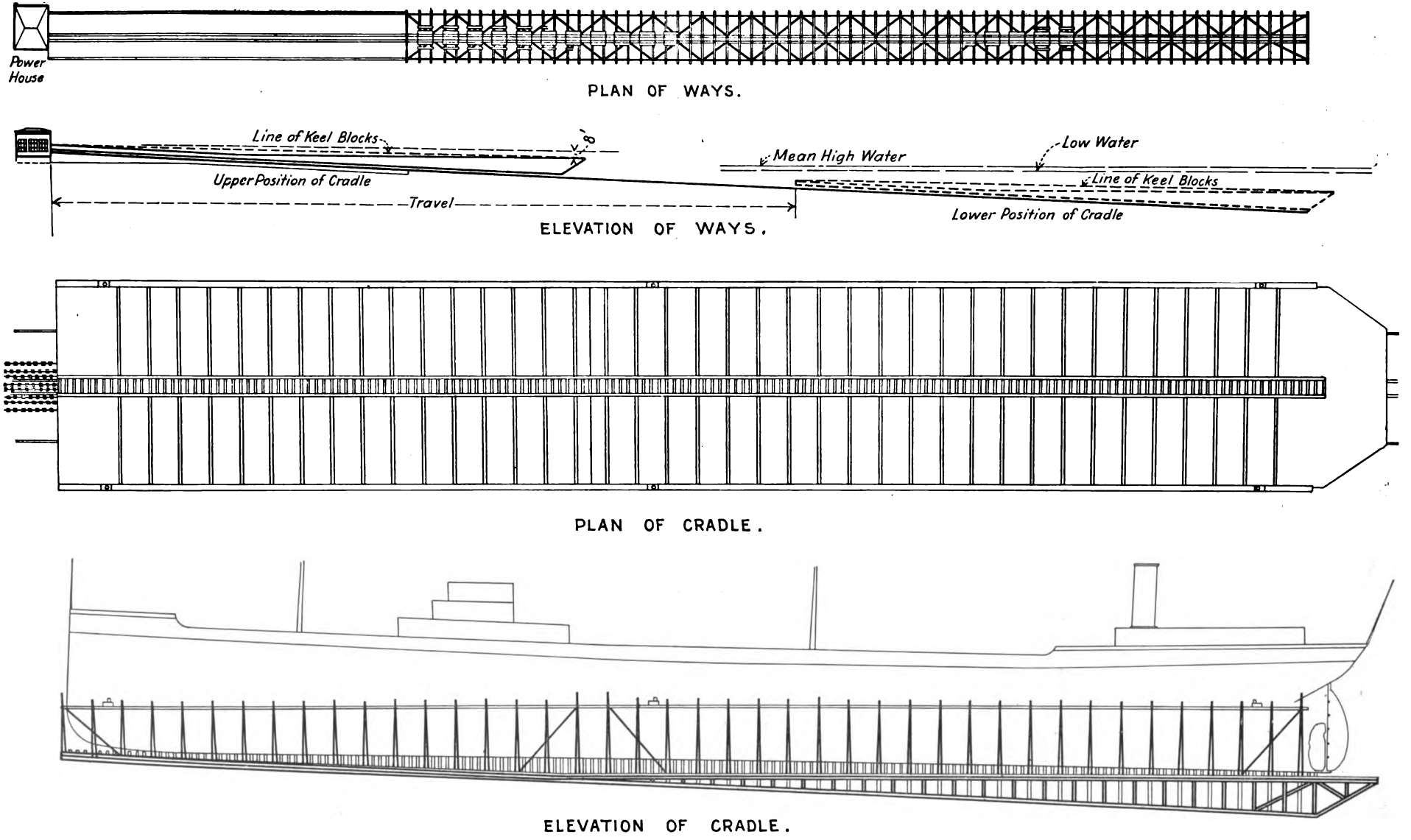

Fig. 3.—General Arrangement of Ways and Cradle of Railway Dry Docks at Moore Shipyard

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combination clutch and gear shifting arrangement permits operating the hoists at a low speed of 16 feet per minute for large ships, or at a speed of 28 feet per minute for lighter loads.

The cradles are provided with elevated framework on the sides, which is always above water. Hand winches for controlling the bilge blocks are mounted on the elevated sides or runways as are also electric capstans (see Fig. 2) for floating the vessel to the proper location over the blocks.

Between the two ships in Fig. 2 may be seen covered trolley ways supported on piles in which are housed two 4-wire trolley systems for supplying electric current to the ships both for lighting and for operation of the electric capstans. The fourth wire is for a signal system, the other side of which is grounded. With this the dock master on the railway signals to the hoisting engineer in the power house. The trolleys consist of bare wires loosely supported on insulators. A collector device attached to the cradle serves to conduct the current to the wiring system on the cradle.

The actual power used to operate these docks varies from a minimum, when the ship is floating, to a maximum, when it is entirely out of the water. In docking the concrete ship *Palo Alto,* weighing 7,115 tons, the power varied from 165 to 565 horsepower, the larger amount being required for only about five minutes at the end of the hoisting period.

Liquid rheostats for controlling the speed of the hoist are ideal, inasmuch as they give very even and gradual acceleration, thus avoiding sudden jerks and consequent strains inherent with grid resistance where the speed is increased in a series of steps.

The Most Interesting Job in the Yard

Which do YOU *think is the most interesting job in the yard? Is it yours? Tell us about it! The letter printed below, taken from the monthly journal of Smith's Dock Company, Ltd., one of the foremost ship repair companies in England, tells why machining in the engineering department has a claim to this title. This is a challenge we invite our readers to accept. All letters published will be paid for at space rates. Speak up! Who's next?*

THERE are several who have laid claim to the title of the most interesting job in the yard, but, from my point of view, they all fail to establish their claim to the title. I claim that my section, or branch, of the work is the most interesting job in the whole category, and that is, machining in the engineering department, embracing, as it does, from drilling 1/16 inch holes to boring out cylinders.

Anyone taking up machining undergoes a course of training beginning with drilling, going right on through screwing, sawing, planing, slotting, milling, shaping, boring, turret lathe, wall-planing.

Very interesting work it is, too. The pleasure and pride of being able to set your jobs and machines so that your work is so accurate that the parts machined fit into their places without any persuasion from quarter hammer or files must be experienced to be appreciated.

We will take drilling as a starting point. The machinist in the making finds a great amount of pleasure, fun and interest in chasing the pops into their proper places and, after the marker-off has performed, this takes some doing.

Next comes sawing. Well, there is a knack of making a saw stick to the track, and once on the right track it is expected to do even time. (Foreman's opinion.)

Shaping comes next. And the interest becomes deeper when you commence to get the tools licked, or ground into the right shape, so as to get the most off in one cut with the least strain and resistance on both tools and machine.

Slotting follows shaping in interest and importance. At first sight a slotting machine gives one the impression of a shaping machine up-ended, but soon its possibilities begin to show themselves as radius work and dovetailing with tapered key-ways, etc., are taken in hand. The first thing that strikes one on a slotting machine is the tendency to put one's fingers where they have no right to be. (See safety first.)

The milling machine, to my mind, takes first place in machining, but it is the last to be introduced into many shops. Almost all jobs come in right for a milling machine. Some fine work I have seen and done on a milling machine from a ½ inch key to milling crank webs, both on the flats and around the outsides.

Planing is nearly like shaping, only one can get bigger work on the machine and handle it with more room to spare for fastening down. The Lancashire drive is a grand invention that makes planing a much more interesting job than ever before. The speeds on the old machines were dead slow and stop, but on these latest there is a great variety of speeds, which makes it possible to do any job, be it either brass, iron, metal or cast steel.

Boring comes next in turn, and for variety and interest it is bad to beat. From boring out holes 3 inches to cylinders of the latest large type is a far cry. Both new work and old has to be very carefully dealt with; the holes to be as round as possible and with a polished glassy finish. Sometimes one gets old work brought in, such as pumps, small cylinders, bearings of every description, and the requests that accompany these jobs are very interesting; such as, "true the hole up and leave it right for using the 'ard year in, yer knaw."

Then the capstan lathe or turret comes in order and importance. The number of tools and operations on these machines is both interesting and surprising. To watch the operator turning, screwing, drilling and tapping the different articles with surprising rapidity makes one think that surely it is as near human as any machine in the shop.

Last, but not least, in my catalogue, comes the wall-planer. This machine starts at the foundation of things (the bedplate) and with care and pride the worker of this machine endeavors to give a firm and sure base to the whole structure of the engine, making it a job well and truly laid.

Next the cylinders must be made to come right and fit exactly in their places on top of the columns, the columns resting on the machine bedplate. So you see, for the correctness of both the top and bottom of the engine, reliance must be placed on the wall-planer.

I could go on enumerating the jobs done by the machines until one would wonder what other work was necessary, but by careful inquiry you will find that machines and machinists find lots of employment for foremen, chargemen, fitters, turners, millwrights and, in some cases, beltmen and tool-fettlers. The last two named are, as a rule, amiable men, indeed.

I could write lots more to prove my claim, but I think this will be sufficient for so good a trade as ours to convince even the latest apprentice in the shop, that the call of the machines is the call of the best in shipbuilding and engineering.

Yours,

Smith's Dock Company, Ltd. NULLI SECUNDUS.

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Strength of Propellers

Analysis Made in Connection With Classification Rules of the American Bureau of Shipping

By Joseph Hecking*

THE propeller is the most vulnerable part of the ship's machinery. Being removed from observation, the improper functioning of its component parts cannot be checked to prevent their complete failure. All failures, whether due to bad workmanship, faulty material or sudden overload conditions, are beyond the control of the engineers, and for this reason the design of the propeller, the selection of its material and the workmanship require the most serious consideration. Only recently a comparatively new vessel lost its propeller in a heavy sea, was driven ashore and became a complete loss.

Materials

By far the greater number of accidents occur to propellers made of cast iron or so-called semi-steel. The blades mostly break at the root of the blade. Where blades break at the tip the cause in all cases is the striking of a floating object.

The fracture of cast iron blades usually shows a good outer skin with a loose graphitic structure of the material at the center. Where no physical test of cast iron is required, it is difficult to decide whether the breakages are due to inferior material or bad workmanship. Even the best grade of iron will develop considerable segregation by inexperienced handling in castings varying in thickness from a knife edge to as much as 12 inches.

Semi-steel is cast iron mixed with some steel shavings. The melting point of cast iron is in the vicinity of 2,100 degrees F. and of steel 2,600 degrees F. This fact should advise extreme caution in making and using this mixture. Broken blades have shown improper amalgamation of the two metals, evidently due to the fact that the steel had been added in the ladle instead of in the crucible.

Cast steel is claimed to be the best material for vessels running in ice. The cheapness of the material compared with bronze is most probably the father of this belief, since the tenacity of steel is not greater than manganese bronze and is lacking the latter's ductility. Cast steel is also subject to considerable pitting, especially in tropical waters, and for this reason no full advantage is generally taken of its great strength.

Manganese bronze has strength and ductility, is not subject to corrosion and pitting and is beyond doubt the most suitable material for all blades. Blades of this material are more apt to bend than to break under sudden overloads.

The minimum tensile strength of the above materials as required by the American Bureau of Shipping is as follows:

Cast Iron	20,000	pounds per square inch
Semi-Steel	28,000	" " " "
Cast Steel	58,000	" " " "
Manganese Bronze	60,000	" " " "

Strength Calculations

Owing to the excellent analysis of Admiral D. W. Taylor and the indefatigable investigations of Admiral C. W. Dyson, the design of the present day propeller follows certain well-defined lines and freak designs are rare. The strength calculations used by these authorities are rather laborious and are correct and complete within the scope of the general assumption entering into propeller calculations such as uniform strength of material, uniform load and speed conditions and standard section moduli. Inasmuch as this method forms the basis and a check of the empirical formulæ further on proposed it may be well to give a synopsis of the same for the benefit of those not familiar with this method.

Taylor's Analysis

There are two forces acting on the surface of the blade, the thrust P in the direction of the shaft and the torque T at right angles to the shaft (see Fig. 1). These two forces are

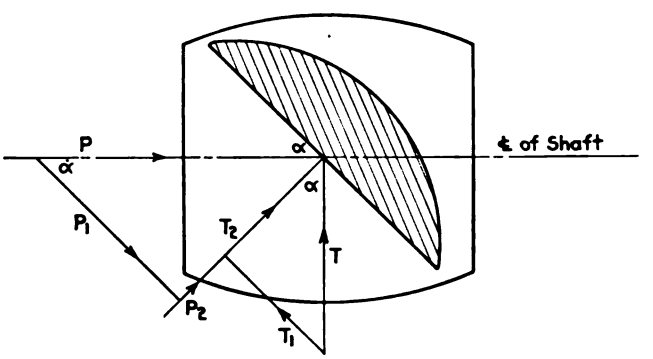

Fig. 1

resolved into their components perpendicular and parallel to the face of the blade. The forces perpendicular to the blade are the torque T_2 and the thrust P_2. The sum of the two forces acts on the face of the blade with *m-n* as the neutral axis, causing tension strains in section *AmnB* and compression strains in section *mCn* (see Fig. 2). The forces parallel to the blade are the thrust P_1 and the torque T_1. These two forces act in opposite directions in line with the face of the

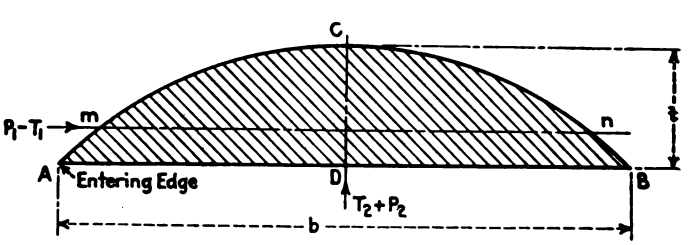

Fig. 2

blade and the difference between the two $(P_1 - T_1)$ with *CD* as axis causes tension strain in part *ACD* and compression strain in part *BCD*. The greatest compression strain is therefore at *C*, due to $P_2 + T_2$, and the greatest tension strain is at *A*, due to $(P_2 + T_2) + (P_1 - T_1)$. The tension strain at *B*, due to $P_2 + T_2$, is partly relieved by the compression strain due to $P_1 - T_1$.

The component forces of P and T may be obtained by trigonometry, thus:

$$\left.\begin{aligned} T_1 &= \sin\alpha \times T;\ T_2 = \cos\alpha \times T \\ P_1 &= \cos\alpha \times P;\ P_2 = \sin\alpha \times P \end{aligned}\right\} \text{(A)}$$

Angle α is the angle of the face of the blade with the centerline of the shaft at a distance from the centerline of 0.125D. The value of 0.125 x diameter of propeller has been taken in this analysis as an average value for the purpose of standardization.

*Engineer Surveyor, Scientific Department, American Bureau of Shipping.

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$$\tan \alpha = \frac{2\pi \times .125D}{H} = \frac{.7854D}{H} \quad (1)$$

where D = diameter of propeller in feet or inches
H = pitch of propeller in feet or inches

The magnitude of the torque T per blade is

$$T = \frac{12 \times 33000 \times \text{S.H.P. } (.92 \text{ I.H.P.})}{2\pi \times \text{Rev.} \times \text{No. (blades)}} = \frac{63000 \times \text{S.H.P.}}{\text{Rev.} \times \text{No. (blades)}} \quad (2)$$

The magnitude of the effective thrust P per blade, based on a maximum propulsive coefficient of .7 S.H.P., is

$$P = \frac{33000 \times .7 \text{ S.H.P.} \times 60}{\text{Knots} \times 6080 \times \text{No. (blades)}} = \frac{228 \times \text{S.H.P.}}{\text{Knots} \times \text{No. (blades)}} \quad (3)$$

While a propulsive coefficient of 0.7 shaft horsepower may rarely be obtained it should be taken as a matter of safety in order to compensate for occasional forced speed loads.

The mean torque arm about the section at 0.125D is 0.31D — 0.125D = 0.185D and the strains due to torque T_1 and T_2 at this section are $\frac{T_1 \times 0.185D}{0.31D}$ or $0.596T_1$ and $\frac{T_2 \times 0.185D}{0.31D}$ or $0.596T_2$ (D in inches) (Fig. 3).

The mean thrust arm about 0.125D is 0.345D — 0.125D = 0.22D. The strains due to thrust are 0.22D x P_1 and 0.22 x P_2.

The above moments apply strictly to the elliptical form of blade only. Where the form departs materially from the elliptical, modifications must be made to the arms. For broad tip or fan shape blades, the equivalent or the design diameter of the blade must be substituted for actual diameter.

The magnitude of the moments of forces T_1, T_2, P_1 and P_2 may be obtained by a combination of the formulæ A, 2 and 3 as follows:

$$\left.\begin{aligned}
\text{Moment of } T_1 &= \frac{63000 \times \text{S.H.P.} \times \sin\alpha \times .596}{\text{Rev.} \times \text{No. of blades}} = \frac{37500 \times \text{S.H.P.} \times \sin\alpha}{\text{Rev.} \times \text{No. of blades}} \\
\text{Moment of } T_2 &= \frac{37500 \times \text{S.H.P.} \times \cos\alpha}{\text{Rev.} \times \text{No. of blades}} \\
\text{Moment of } P_1 &= \frac{228 \times \text{S.H.P.} \times \cos\alpha \times .22D}{\text{Knots} \times \text{No. of blades}} = \frac{\text{S.H.P.} \times \cos\alpha \times 50D}{\text{Knots} \times \text{No. of blades}} \\
\text{Moment of } P_2 &= \frac{\text{S.H.P.} \times \sin\alpha \times 50D}{\text{Knots} \times \text{No. of blades}}
\end{aligned}\right\} \quad (4)$$

The moment of resistance of the blade section is figured on the basis of a parabola (Fig. 2). For axis *mn* the section modulus for *m n B A* under tension strain is $\frac{bt^2}{8.75}$ and for *mCn* under compression strain is $\frac{bt^2}{13.125}$. For axis *CD* the section modulus for *ACB* is $\frac{b^2t}{15}$ where the half toward *A* is under tension and the half toward *B* under compression. *b* and *t* represent the breadth and the thickness of the blade in inches at a radius of 0.125D from the centerline of the shaft.

In addition to the stresses due to thrust *P* and torque *T* those due to the centrifugal force must be considered. The centrifugal force F_c produces uniform tension strain over the whole blade section equal to $\frac{F_c}{b \times .67\ t}$. Excepting propellers of a high number of revolutions this strain is comparatively small and may be neglected. Where the blades are raked additional stresses are produced due to the moment of the centrifugal force (Fig. 3) and these must be considered in the calculations for strength.

The centrifugal force is calculated by the formula:

$$F_c = \frac{W \times v^2}{r \times 32.16}\ ;\ v = 2\ r\ \pi \times R_s \quad (5)$$

Where W = weight of blade outside of radius of 0.125D, in pounds.
v = velocity in feet per second at center of gravity.
r = radius of center of gravity of blade in feet from centerline of shaft.
R_s = revolutions per second.

In view of the fact that blades rake straight aft, the centrifugal force should be resolved into its components similar to thrust *P* (Fig. 1), but no grave error is committed

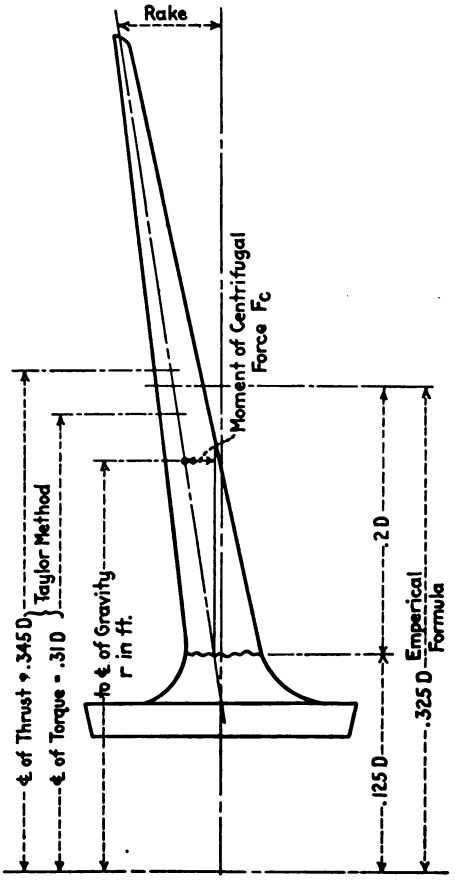

Fig. 3

by assuming the total centrifugal force to act perpendicular to the blade, since both components will cause tension strain at *A*. The tension strain at *A* due to thrust and torque is therefore increased by $\frac{\text{moment of } F_c \times 8.75}{b \times t^2}$ and the compression strain at *C* is increased by about $\frac{\text{moment of } F_c \times 13.125}{b \times t^2} \times .7$ (6)

In view of the fact that the material, with the possible exception of cast steel, is considerably stronger in compression than in tension, it will suffice to solve for tension stresses only.

EXAMPLE

An example of the process of the complete calculations is given herewith.

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Propeller 4-bladed, built-up, 17 feet diameter, 15 feet pitch, 2,575 shaft horsepower. 82 revolutions per minute, 10½ knots, breadth b = 29 inches, thickness t = 6.07 inches,

$$\text{tan angle } \alpha = \frac{.7854 \times 17}{15} = .89; \quad \cos \alpha = .747;$$

$\sin \alpha = .665$, weight of one blade 2,460 pounds.

$$\text{Moment of } T_1 = \frac{37500 \times 2575 \times .665}{82 \times 4} = 196{,}000 \text{ inch pounds}$$

$$\text{Moment of } T_2 = \frac{37500 \times 2575 \times .747}{82 \times 4} = 220{,}000 \text{ inch pounds}$$

$$\text{Moment of } P_1 = \frac{2575 \times .747 \times 50 \times 204}{10.5 \times 4} = 468{,}000 \text{ inch pounds}$$

$$\text{Moment of } P_2 = \frac{2575 \times .665 \times 50 \times 204}{10.5 \times 4} = 416{,}000 \text{ inch pounds}$$

$$\text{Moment of } F_c = \frac{2460 \times (6.28 \times 4.67 \times 1.37)^2 \times 6.25}{4.67 \times 32.16} = 165{,}000 \text{ inch pounds}$$

$$\text{Compression stress at } C = S_c = 416000 + 220000 + (.7 \times 165000) \div \frac{.29 \times 6.07^2}{13.125}$$

$$= \frac{751000 \times 13.125}{29 \times 6.07^2} = 9{,}200 \text{ pounds per square inch}$$

$$\text{Tension stress at } A = S_t = (416000 + 220000 + 165000) \div \frac{29 \times 6.07^2}{8.75} + (468000 - 196000) \div \frac{29^2 \times 6.07}{15} =$$

$$\frac{801000 \times 8.75}{29 \times 6.07^2} + \frac{27200 \times 15}{29^2 \times 6.07} = 7370 \text{ pounds per square inch}$$

Empirical Rule

The results obtained by the Taylor method for ordinary merchant vessels with normal revolutions may be arrived at by an empirical formula which has been used at our shipyards. It is assumed that the total shaft horsepower produces a thrust perpendicular to the blade. The load per blade

$$L = \frac{\text{S.H.P.} \times 33000 \times 12}{\text{H (inch)} \times \text{Rev.} \times \text{No.}} \quad (7).$$

The load arm is variously taken, but for the purpose of standardization the same may be considered to be $0.325D$ from the center of the shaft (Fig. 3). The point of maximum strain may also in

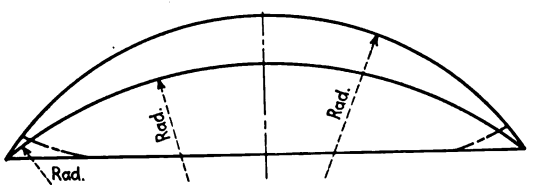

Fig. 4

this case be taken at $0.125D$ from the center so that the moment of L is $0.325D - 0.125D = 0.2D$.

The cross section of cast iron blades at $0.125D$ takes the form of a segment of a circle (Fig. 4). Thinner blades of cast steel and bronze are formed with a radius at the edges. According to Dyson the cutting away of the blade at the driving side, as shown in dot and dash, is a useless refinement. In any case a section modulus of $\frac{t^2 b}{12}$ is considered sufficiently correct for all practical purposes. If S represents the fibre stress at the radius of $0.125D$, then

$$\frac{t^2 b}{12} S = \frac{\text{S.H.P.} \times 33000 \times 12 \times .2\text{D}}{\text{H} \times \text{R} \times \text{No.}}$$

$$S = \frac{\text{S.H.P.} \times 950000 \times \text{D}}{\text{H} \times \text{R} \times \text{No.} \times t^2 \times b} \quad (8)$$

where D and H are the diameter and pitch of the propeller in inches.

Or, if f_p is the allowable fibre stress of the blade material

$$t^2 = \frac{\text{S.H.P.} \times 950000 \times \text{D}}{\text{H} \times \text{Rev.} \times \text{No.} \times b \times f_p} \quad (9)$$

Comparison of Formulae

The results of formula (8) have been carefully checked with the Taylor formula on about 30 different designs and a

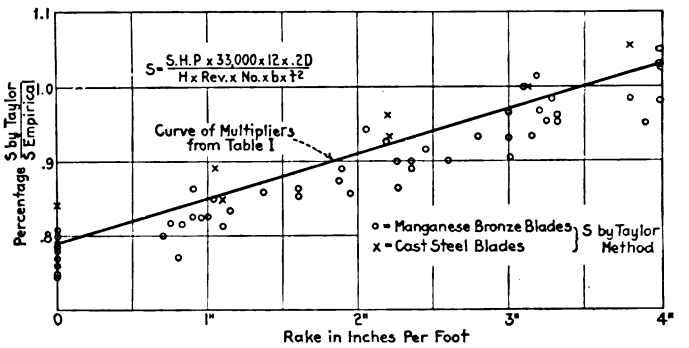

Fig. 5

comparison is shown in the curves, Figs. 5 and 6. The 1.0 line in both cases represents the value for S obtained by the above empirical formula (8), while the o and x points rep-

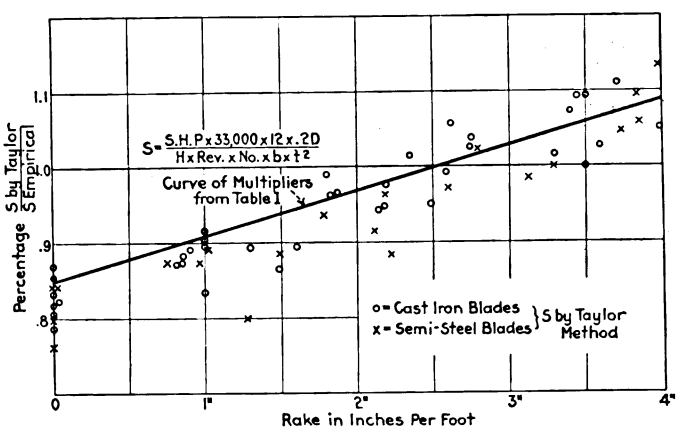

Fig. 6

resent the values obtained by the Taylor method. It is evident that a correction should be made to the value of S depending on the rake, and the curves running diagonally through the o and x have been taken as safe average values. The correction factors for the values of S in formula (8) or of t^2 in formula (9), as taken from the curves are therefore as follows:

Table I

Rake in inches per ft.	0	½	1	1½	2	2½	3	3½	4
Cast iron and semi-steel	.85	.88	.91	.94	.97	1.0	1.03	1.06	1.09
Cast steel and manganese bronze	.79	.82	.85	.88	.91	.94	.97	1	1.03

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Propeller Thickness Based on Diameter of Propeller Shaft

In view of the fact that the shaft diameters are always determined before the propeller is designed, the thickness of the blade may be based on the diameter of the propeller shaft. The rules of the American Bureau of Shipping require that the diameter of the line shaft d_1 of constant torque or rotary engines and motors shall be determined by the formula

$$d_1 = \sqrt[3]{\frac{\text{H.P.} \times 65}{\text{Rev.}}} \quad (10)$$

This formula is derived from the twisting moment formula

$$M_t = \frac{12 \times \text{H.P.} \times 33000}{2\pi \times \text{Rev.}} = .196 d^3 f,$$

where f represents a working stress of 5,000 pounds per square inch.

$$d^3_1 = \frac{12 \times \text{H.P.} \times 33000}{2\pi \times \text{Rev.} \times .196 \times 5000} = \frac{\text{H.P.} \times 65}{\text{Rev.}} \text{ (Approx.)}$$

The diameter of the propeller shaft d_p is required to be 1.1 times the diameter of the line shaft, or

$$d^3_p = \frac{\text{H.P.} \times 65 \times 1.1^3}{\text{Rev.}} = \frac{\text{H.P.} \times 86}{\text{Rev.}} \quad (11)$$

The relation between t^2 and d^3_p for constant torque engines, where the correction factor according to Table I, is 1, is

$$\frac{t^2}{d^3_p} = \frac{\text{H.P.} \times 950000 \times D \times R}{H \times R \times \text{No.} \times b \times f_p \times \text{H.P.} \times 86} = \frac{11000 \times D}{H \times \text{No.} \times b \times f_p}$$

$$t^2 = \frac{11000 \times D \times d^3_p}{H \times \text{No.} \times b \times f_p} \quad (12)$$

Allowable Working Stresses

Experience has shown that the following fibre stresses at the root of the blade should not be exceeded:

$f_p = 2{,}750$ pounds per square inch for cast iron
$= 3{,}600$ " " " " " semi-steel
$= 5{,}200$ " " " " " cast steel
$= 6{,}200$ " " " " " manganese bronze

Thickness of Blades

On the basis of these working stresses formula (12) will give a thickness of blades at a radius of $0.125D$, where the correction factor in Table I is 1, as follows *for turbines and motors:*

Cast Iron—Rake 2½ inches per foot

$$t = \sqrt{\frac{11000 \times D \times d^3_p}{P \times \text{No.} \times b \times 2750}} = 2\sqrt{\frac{D \times d^3_p}{P \times \text{No.} \times b}}$$

Semi-steel—Rake 2½ inches per foot

$$t = \sqrt{\frac{11000 \times D \times d^3_p}{H \times \text{No.} \times b \times 3600}} = 1.75\sqrt{\frac{D \times d^3_p}{H \times \text{No.} \times b}}$$

Cast steel—Rake 3½ inches per foot

$$t = 1.45\sqrt{\frac{D \times d^3_p}{H \times \text{No.} \times b}}$$

Manganese Bronze—Rake 3½ inches per foot

$$t = 1.34\sqrt{\frac{D \times d^3_p}{H \times \text{No.} \times b}} \quad (13)$$

Reciprocating Engines

Reciprocating engines have an irregular turning effort; the ratio of maximum to mean turning effort varies from 1.8 for compound engines to about 1.2 for balanced quadruple expansion engines. The value of maximum to mean turning effort has been taken as 1.25, which is expected safely to cover ordinary merchant triple and quadruple expansion engines. The maximum turning effort for which the propeller shaft is

Data Sheet

| Ship | | |

designed equals 1.25 times the turning effort of rotary engines or

$$d^3_p = \frac{H.P. \times 86 \times 1.25}{R} = \frac{H.P. \times 107}{R} \quad (14)$$

The force acting perpendicular to the blade is composed of thrust, torque and centrifugal force and may be considered uniform. The relation between t^2 and d^3_p for reciprocating engines is therefore

$$\frac{t^2}{d^3_p} = \frac{H.P. \times 950000 \times D \times R}{H \times R \times No. \times b \times f_p \times H.P. \times 107} = \frac{8900 \times D}{H \times No. \times b \times f_p}$$

$$t^2 = \frac{8900 \times D \times d^3_p}{H \times R \times No. \times b \times f_p} \quad (15)$$

Inserting the fibre stresses f_p as before, the thickness of blades for reciprocating engines, where the correction factor in Table I is 1, is

$$\left.\begin{array}{l} \text{Cast iron—Rake } 2\tfrac{1}{2} \text{ inches per foot} \\ t = \sqrt{\dfrac{8900 \times D \times d^3_p}{H \times No. \times b \times 2750}} = 1.8 \sqrt{\dfrac{D \times d^3_p}{H \times No. \times b}} \\ \text{Semi-steel—Rake } 2\tfrac{1}{2} \text{ inches per foot} \\ t = \sqrt{\dfrac{8900 \times D \times d^3_p}{H \times No. \times b \times 3600}} = 1.57 \sqrt{\dfrac{D \times d^3_p}{H \times No. \times b}} \\ \text{Cast steel—Rake } 3\tfrac{1}{2} \text{ inches per foot} \\ t = 1.31 \sqrt{\dfrac{D \times d^3_p}{H \times No. \times b}} \\ \text{Manganese bronze—Rake } 3\tfrac{1}{2} \text{ inches per foot} \\ t = 1.2 \sqrt{\dfrac{D \times d^3_p}{H \times No. \times b}} \end{array}\right\} \quad (16)$$

For determining the thickness of blades of various rakes, the values of t^2 in formula (12) for turbines and motors, and in formula (15) for reciprocating engines, are to be multiplied by the factors in Table I depending on the rake of the propeller. Taking as an example a cast steel propeller with a rake of $1\frac{1}{2}$ inches per foot for a reciprocating engine correction factor, Table I = .88, inserted in formula (15) gives

$$t^2 = \frac{8900 \times D \times d^3_p \times .88}{H \times R \times No. \times b \times 5200} = \frac{1.5 \times D \times d^3_p}{H \times R \times No. \times b}$$

$$t = 1.23 \sqrt{\frac{D \times d^3_p}{H \times R \times No. \times b}} \quad (17)$$

The numerical value before the root has been found by this method for various materials and rakes and is tabulated as "*C*" in the following:

from the neutral axis expressed in terms of the pitch circle (r) is about 0.4 r. The moment of resistance of the studs is therefore $a \times n \times 0.4\, r \times f_b$, where

a = area of one stud at bottom of thread
n = number of studs on driving side of blade
r = diameter of pitch circle in inches
f_b = fibre stress = 4,500 pounds per square inch.

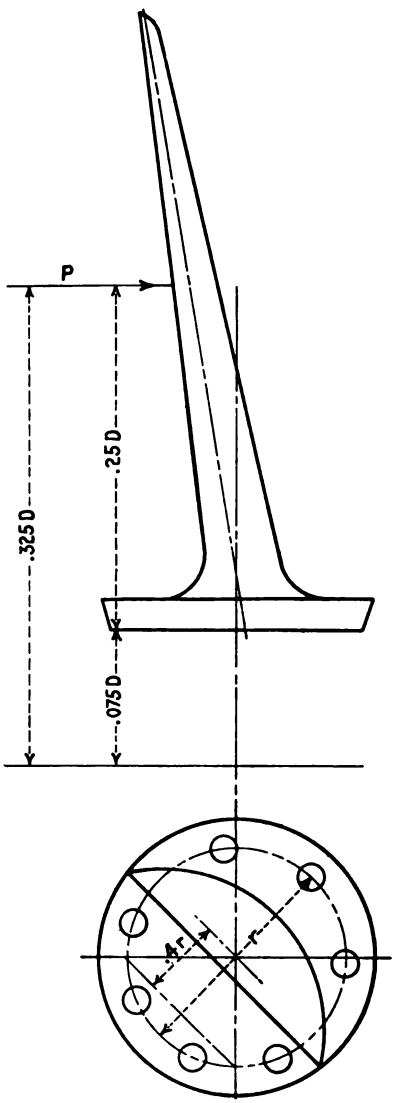

Fig. 7

TABLE II.—*Values of C*

Rake of Blade, Inches Per Foot	Cast Iron Engines		Semi-Steel Engines		Cast Steel Engines		Manganese Bronze Engines	
	Rotary	Recip.	Rotary	Recip.	Rotary	Recip.	Rotary	Recip.
0	1.85	1.66	1.61	1.45	1.29	1.17	1.19	1.07
½	1.88	1.69	1.64	1.48	1.32	1.19	1.21	1.09
1	1.91	1.72	1.67	1.50	1.34	1.21	1.23	1.11
1½	1.94	1.75	1.70	1.53	1.36	1.23	1.25	1.12
2	1.97	1.77	1.72	1.55	1.39	1.25	1.27	1.14
2½	2.00	1.80	1.75	1.57	1.41	1.27	1.29	1.16
3	2.03	1.83	1.78	1.60	1.43	1.29	1.31	1.18
3½	2.06	1.86	1.80	1.62	1.46	1.31	1.33	1.2
4	2.09	1.89	1.82	1.64	1.48	1.33	1.35	1.22

STUDS (Fig. 7)

The thrust P exerts a bending moment of $P \times 0.25\, D$ at the joint between hub and flange. The half of the flange opposite P is under compression and the studs in this half are not subject to stress. The half on the side of P is in tension and the studs are therefore in tension. In most cases four studs are fitted on this side and the average distance

The bending moment due to thrust at the joint equals

$$P \times .25D = \frac{H.P. \times 33000 \times 12 \times 0.25D}{H \times R \times N} = a \times n \times 0.4r \times 4500$$

$$a = \frac{H.P. \times 33000 \times 12 \times 0.25D}{H \times R \times N \times n \times 0.4r \times 4500} = \frac{55 \times H.P. \times D}{H \times R \times N \times n \times r}$$

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According to formulae (11) and (14) the average value of

$$d^3_p = \frac{H.P. \times (86 + 107)}{R \times 2} = \frac{H.P. \times 96.5}{R}, \text{ say } \frac{H.P. \times 100}{R}$$

The relation of "a" to d^3_p is

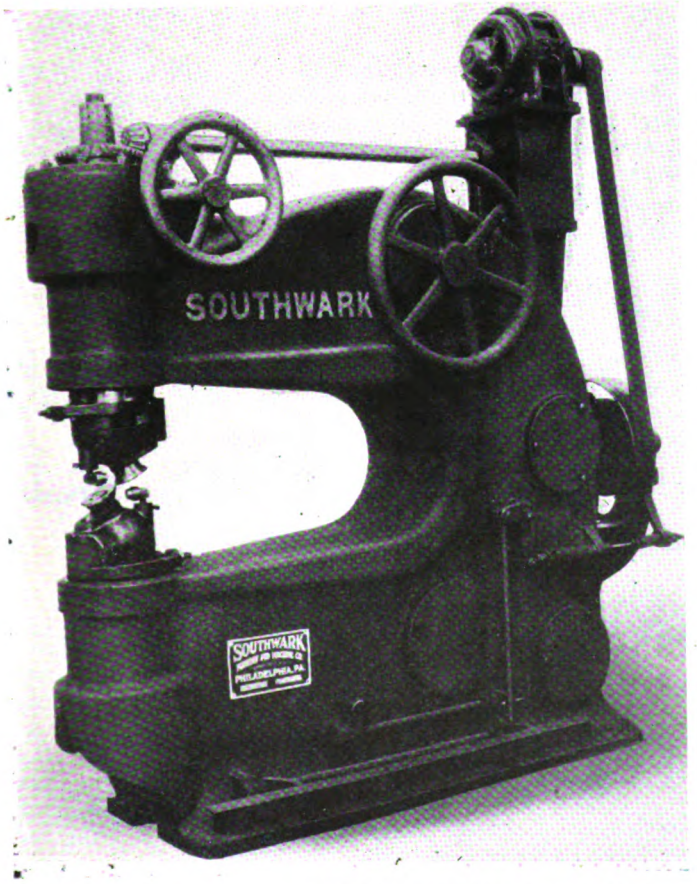
$$\frac{a}{d^3_p} = \frac{55 \times H.P. \times D \times R}{H \times R \times N \times n \times r \times H.P. \times 100} = \frac{0.55D}{H \times N \times n \times r}$$

$$a = \frac{0.55D \times d^3_p}{H \times N \times n \times r} \quad (18)$$

The power in reversing the engine is not greater than ¾ of the ahead power, and where the number of bolts on the forward half of the flange is ¾ of the bolts in the after half, the joint may be considered of equal strength.

Turret Rotary Shear for Cutting Metal Without Swinging the Stock

FOR cutting various shapes from sheet metal without turning the sheet or plate during the cut, the Southwark Foundry and Machine Company, Philadelphia, Pa., has produced a turret rotary shear, which cuts an opening up to double the throat depth at any distance from the end of the sheets or plates regardless of their length. Four sizes of this machine are available, having capacities up to ⅜-inch gage metal, but larger sizes are also built having shearing capacities up to 1-inch plate. The No. 3 Southwark-Gray



No. 3 Southwark-Gray Double Turret Rotary Shear

shear illustrated is of special interest because of the double turret with which it is equipped.

As stock is fed through the machine, the line to be cut is followed by means of the turret which may be revolved by guide wheels on either side of the machine. Cuts are made with minimum radii, equal to the radius of the cutters in stock not heavier than half the capacity of the machine, while on heavier stock than this the minimum radii will be slightly larger than the radius of the cutters. On the double turret machine for material ⅜-inch thick and heavier, both the upper and lower cutters are at an angle, which is unchanged in whatever position the turret may be turned by the hand wheel. When the position of the cutters is changed, the direction of the feed is correspondingly changed, insuring automatic feeding of materials at all times. Foot treads are provided on each side of the machine which control the cutters, so that when difficult cuts are being made, the cutters may be started or stopped within a fraction of an inch.

In starting an inside cut, sufficient pressure is provided to force the cutters through the sheet or plate before the cut is commenced. Horizontal and vertical adjustments are provided to insure correct alinement of the cutting edges without the cutters coming together and jamming.

In general sheet metal work the shear may be used to advantage cutting elbows, tees, hoods, dust collectors, blower piping, gaskets, liners, templates, ventilator work, shear plates for ship, boiler and tank work, and the like.

Triple Expansion Engine Designed for Ships of 10,000 to 12,000 Deadweight Tons

THE Hamilton 3,200 indicated horsepower triple expansion marine engine, built by The Hooven, Owens, Rentschler Company, Hamilton, O., is designed to propel ships of from 10,000 to 12,000 tons deadweight at an average speed of 10½ knots. Triple expansion engines have reached a high state of development and as they are manufactured by numerous firms they will, of course, have variations in design but the following data represent good practice values which are interesting for comparative purposes:

Salient Characteristics

1.	Diameter high pressure cylinder	27½ inches
2.	Diameter intermediate pressure cylinder	46 inches
3.	Diameter low pressure cylinder	78 inches
4.	Length of stroke	51 inches
5.	Steam pressure at throttle	210 pounds
6.	Revolutions per minute	75
7.	Piston speed, feet per minute	638
8.	Indicated horsepower	3,200
9.	Diameter crankshaft	16 inches
10.	Diameter and length main bearing	16 by 16 inches
11.	Diameter and length crankpin	16¼ by 15¾ inches
12.	Diameter and length crosshead pin	8 by 8½ inches
13.	Length of centers connecting rod	114 inches
14.	Diameter connecting rod, top and bottom	6½-7½ inches
15.	Length and width crosshead slipper	30 by 16 inches
16.	Diameter high pressure valve, top and bottom	12-11½ inches
17.	Diameter intermediate pressure valve, top and bottom,	24½-24 inches
18.	Diameter valve stem, through stuffing box and guide,	4-4½ inches
19.	Diameter piston rod, through stuffing box	7¼ inches
20.	Lineal clearance, top and bottom	½-⅝ inches
21.	Diameter steam pipe	9 inches
22.	Diameter exhaust pipe	27 inches
23.	Diameter and length link block pin	4½ by 4¼ inches
24.	Diameter and width eccentrics	29¾-44 by 5 inches
25.	Diameter and length eccentric rod pin	3½ by 3½ inches
26.	Diameter eccentric rod, top and bottom	3½-4½ inches
27.	Diameter and length drag link pin	2½ by 2⅝ inches
28.	Width and height link bar	1¾ by 5½ inches
29.	Diameter and stroke reverse engine	14 by 24 inches
30.	Diameter reverse shaft	7 inches
31.	Diameter and stroke air pump	28 by 24 inches
32.	Diameter and stroke bilge pumps (2)	5 by 24 inches
33.	Diameter and stroke turning engine	8 by 6 inches
34.	Diameter thrust shaft	16 inches
35.	Diameter and number collars	24½ inches-12
36.	Thickness thrust collar	2½ inches
37.	Diameter and number coupling bolts	3¾ inches-6

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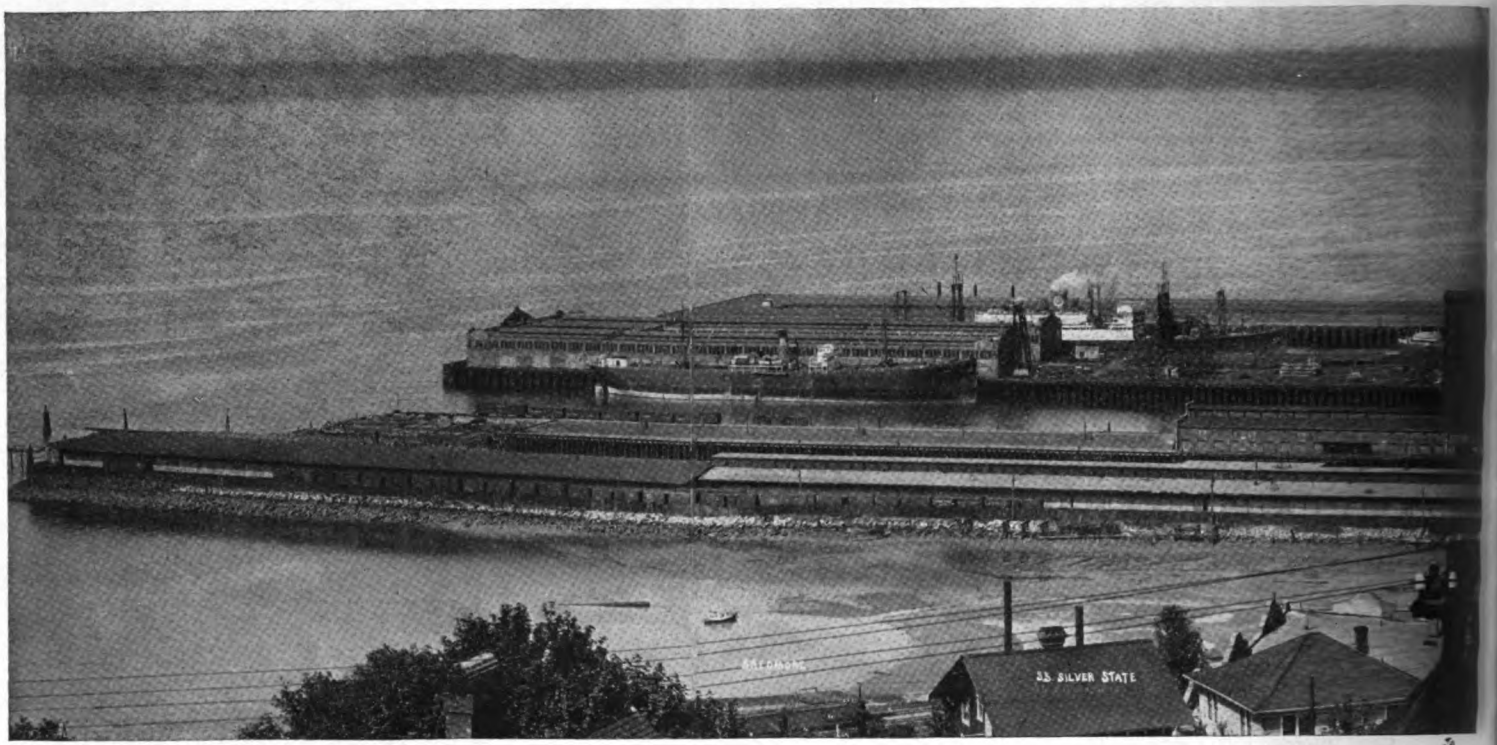

View Showing Four Shipping Board Vessels, Representing an Investment by the American People of $27,000,000, Discharging Are Engaged in the New Passenger and Freight Service Between Puget Sound and the Orient. They are, Right

American Shipping Gaining Strong Position in North Trans-Pacific Commerce

WHEN, early in July, four large United States Shipping Board vessels lay at one time at Pier B, of the Port of Seattle, the largest commercial wharf in the world, a graphic picture was presented of the rapid progress being made in the effort to win ascendency for the American flag in the commerce of the North Pacific, via the Great Circle trade route to and from the Orient. The mammoth terminal, constructed by Seattle at a cost of more than $5,000,000, is justifying the faith of its builders by becoming the home berth of an increasing fleet of American ships engaged in trans-Pacific commerce.

American Terminus of Admiral Line

Pier B, of the great terminal is being used as the American terminus of the Admiral Line, which inaugurated the all-American passenger and freight service between Puget Sound and Oriental ports, with the sailing of the *Wenatchee* on April 9, followed by the *Silver State* on July 9. The four ships which lay at Pier B were the passenger and freight liners *Wenatchee, Keystone State* and *Silver State* and the freighter *Edmore,* all Shipping Board vessels allocated to the Admiral Line for operation. They represent an investment by the people of the United States of $27,000,000.

Pier Cost $2,500,000

It is expected that additional vessels will be allocated to the Admiral Line for this service, making the capacity for passengers and freight of the American line far greater than that of any of its foreign competitors which, in the past, have carried the bulk of American commerce out of Puget Sound. The vessels which have so far sailed in the service have carried large cargoes, encouraging the belief of Admiral Line officials that American ships can gain control of the trans-Pacific passenger and freight business originating in the United States, which constitutes the bulk of the traffic.

Pier B, which can accommodate many more than the four large vessels shown in the picture, was recently completed at a cost of $2,500,000. It is 2,500 feet long and 365 feet wide, larger in area than Pier A, the first constructed, which is 2,540 feet long by 310 feet wide. The piers are equipped with transit sheds and modern machinery, insuring rapid and economical handling of cargo and giving American ships a decided advantage in this respect over Canadian and British ships in British Columbia ports.

With a splendid fleet, to be still further augmented, and the best terminal facilities in the world, the Admiral Line looks for rapid realization of its purpose to gain ascendency for the American flag on the Great Circle trade route.

Hoover Reorganizes the Foreign Trade Service of the Department of Commerce

AS part of the general reorganization plan of the foreign trade service, upon which Secretary Hoover has been engaged ever since he became the head of the Department of Commerce last March, for the purpose of placing the facilities and influence of the department behind the various movements to build up American overseas trade, the department has announced during the past month a number of important steps in the reorganization of the Bureau of Foreign and Domestic Commerce. The bureau is being reorganized on a commodity basis, the object of which, according to the announcement by Secretary Hoover, is threefold, as follows:

1. That specialists in the different great industrial divisions should be incorporated in the bureau for the purpose of giving expert direction to the staff of 600 foreign agents, including commercial attaches, consular officers, trade commissioners and special agents, as to the investigations and service that will be of importance and most useful to their particular branch of industry.
2. That they may, by maintaining close communication

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and Loading at Pier B of the $5,000,000 Terminal of the Port of Seattle. The Four Vessels, Allocated to the Admiral Line, to Left, the Passenger and Freight Liners Wenatchee, Keystone State and Silver State and the Freighter Edmore

with trade associations in different industries, keep in touch with the character of service, information and investigation needed in these industries.

3. That the material in the way of information coming in from these various agents may be edited and prepared in such a manner as to be of the most practicable service.

Directors Appointed for Commodity Divisions

The following commodity divisions have so far been established: Iron and steel, lumber, industrial machinery, electrical equipment and supplies, foodstuffs, automotive equipment, fuels, textiles, shoes and leather products, agricultural implements and vehicles, rubber products. Announcements have also been made from time to time during the past few weeks of the appointment of the men who have been placed in charge of these divisions, who have been chosen from the industries themselves and in most instances have been selected in cooperation with the trade associations representing the different industries so that they may bring to the department not only specialized knowledge and sympathetic understanding of the problems of these particular industrial groups, but that they also in turn may interpret to the members of the foreign staff the exact needs of these industries in this country and develop the information received in such form as may be of the greatest use in the industry to which it is related. The heads of the various divisions are expected to keep in close touch with the centers of the various industries through the trade associations, through trade papers and through the producers and dealers individually so as to ascertain the exact nature of official assistance most urgently needed or which will be most generally useful.

A Transportation Division Established

In addition to the commodity divisions, there has been created within the bureau a new transportation division, of which E. S. Gregg, formerly of Galveston, Texas, and more recently of New York City, has been appointed chief. This division is to help American business men in their overseas work in so far as it relates to transportation and the movement of freight by land or sea. Mr. Gregg is a graduate of Austin College, Texas, where he received an A. B. degree, and he also took a graduate course in transportation at the University of Chicago. During the war he was connected with the shipping section of the general staff of the War Department. Since the war he has been associated with the American International Corporation as adviser on shipping conditions. He is also the author of numerous articles on shipping subjects.

Mr. Gregg says that the first work to be undertaken will be an intensive study of ocean shipping with a view to determining the minimum amount of shipping tonnage needed for given ports of the United States and in connection with the maintenance of established trade routes and the establishment of new routes. He will work in close cooperation with the Shipping Board. Later he expects to give consideration to matters relating to export rail rates and may cooperate with industries who are interested in seeking the establishment of such rates.

Commerce Reports Changed to a Weekly Magazine

As a part of the general plan of making the foreign trade service more directly useful, the *Commerce Reports*, which have been issued by the department for years daily, have been changed to a weekly publication beginning with September 5. It is proposed to place information with regard to foreign trade before American business men in more intelligible and constructive form.

Indicator Locking Device

A DEVICE for automatically locking a mechanically operated shaft in any determined position or point has been developed by Swan, Hunter and Wigham Richardson, Ltd., Wallsend-on-Tyne, England. The device is used for locking ships' watertight doors in a closed or open position; for attachment to any class of hand operated door where a shaft can be utilized for the purpose of controlling traffic or exits from public places; or for attaching to sluice valves where a definite opening is essential to ensure a certain rate of flow of the liquid passing. In the latter case, the opening giving the required rate of flow having been

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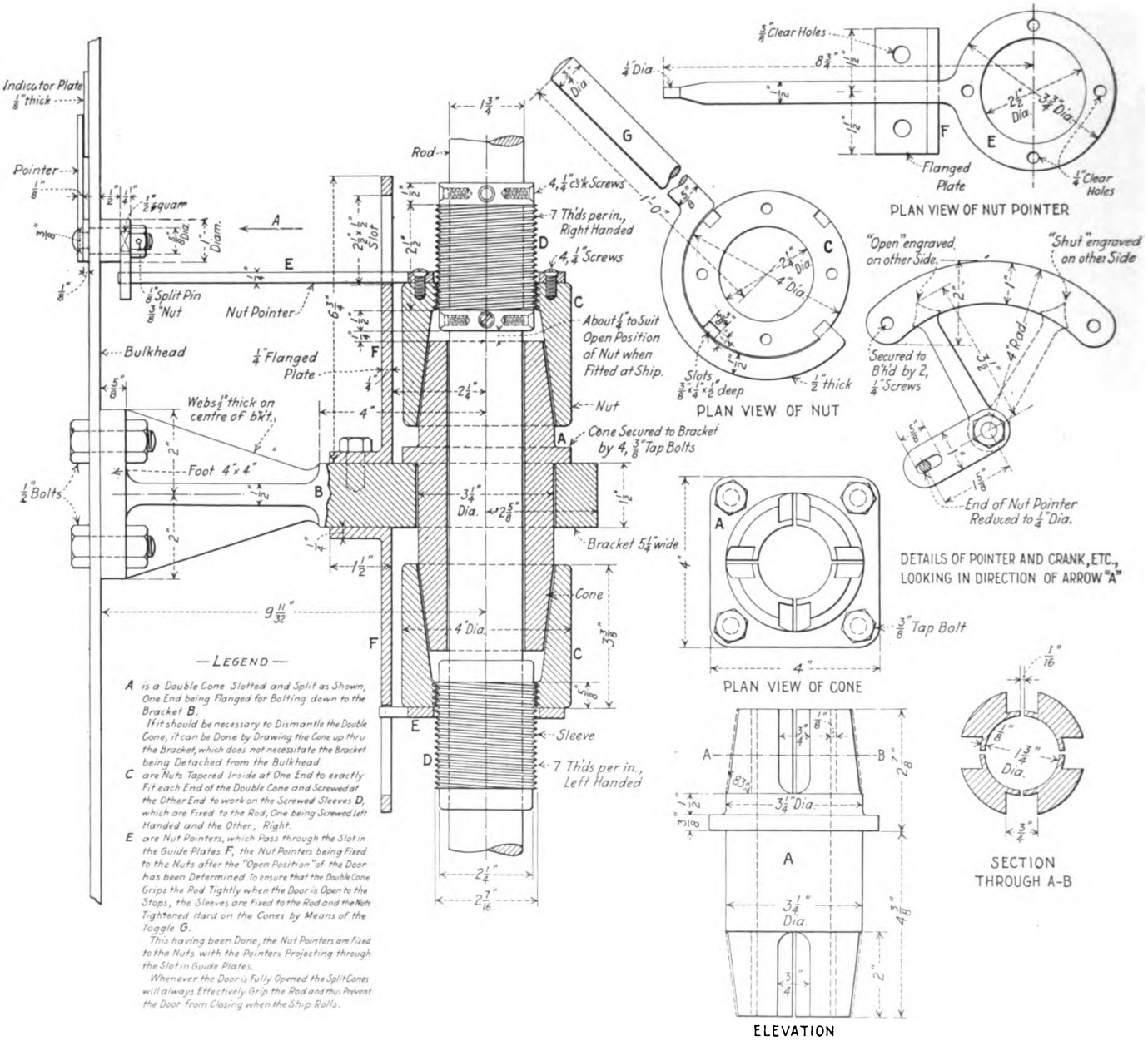
ascertained, the shaft controlling the operating mechanism can be locked definitely and the indicator plate marked to indicate the rate of flow.

For ships' watertight doors the device is particularly adaptable and can be so applied as to operate on any door so as to lock same in any determined position, or open fully or closed. This operation can be carried out from several decks above the doors or at the door itself as circumstances demand. Once the device is attached it will answer the purpose for which it is set, the synchronizing action of the coned nuts on the split bush as they travel towards each other secures a positive locking action, and at the same time indicates, as previously determined, the actual position of the door on the indicator plate, making it foolproof. The operating lever, which is usually a ratchet, opens or closes the door and locks same in either position as circumstances demand.

It has many times been found urgently necessary to close immediately watertight doors at the point of the door itself but owing to independent locking devices attached to some doors to prevent creeping it could not be accomplished without first detaching the locking arrangement. With this device a person could be fastened in between two bulkheads but he could easily release himself although the doors may have been locked from above to a dead closed position.

The device, where attached, will give a positive locking action. There is no friction in opening or closing a door, where this device is attached, except at the moment when the synchronizing action of the traveling coned nuts make contact with the split sleeve or bush which grips the shaft.


Indicator Plate
Pointer
Rod
Bulkhead
Nut Pointer
Flanged Plate
Webs thick on centre of bkt.
Foot 4"x4"
Bolts
Nut
Cone Secured to Bracket by 4, Tap Bolts
Bracket wide
Cone
Sleeve
7 Th'ds per in., Right Handed
7 Th'ds per in., Left Handed
4, Screws
About to Suit Open Position of Nut when Fitted at Ship.
Slots deep
thick
PLAN VIEW OF NUT
PLAN VIEW OF NUT POINTER
"Open" engraved on other Side.
"Shut" engraved on other Side
Secured to B'hd by 2, Screws
End of Nut Pointer Reduced to Dia.
DETAILS OF POINTER AND CRANK, ETC., LOOKING IN DIRECTION OF ARROW "A"
Tap Bolt
PLAN VIEW OF CONE
SECTION THROUGH A-B
ELEVATION
—LEGEND—
A is a Double Cone Slotted and Split as Shown, One End being Flanged for Bolting down to the Bracket B.
If it should be necessary to Dismantle the Double Cone, it can be Done by Drawing the Cone up thru the Bracket, which does not necessitate the Bracket being Detached from the Bulkhead.
C are Nuts Tapered Inside at One End to exactly Fit each End of the Double Cone and Screwed at the Other End to work on the Screwed Sleeves D, which are Fixed to the Rod, One being Screwed Left Handed and the Other, Right.
E are Nut Pointers, which Pass through the Slot in the Guide Plates F, the Nut Pointers being Fixed to the Nuts after the "Open Position" of the Door has been Determined. To ensure that the Double Cone Grips the Rod Tightly when the Door is Open to the Stops, the Sleeves are Fixed to the Rod and the Nuts Tightened Hard on the Cones by Means of the Toggle G.
This having been Done, the Nut Pointers are Fixed to the Nuts with the Pointers Projecting through the Slot in Guide Plates.
Whenever the Door is Fully Opened the Split Cones will always Effectively Grip the Rod and thus Prevent the Door from Closing when the Ship Rolls.

Details of Combined Locking Gear

Annual Index for 1921

Copies of the annual index of MARINE ENGINEERING AND SHIPPING AGE for the year 1921 will be mailed on January 1, 1922, to all of our subscribers who send us a request for it on or before December 1, 1921. As the edition of the index will be limited to the number ordered up to December 1, all readers desiring a copy should send in their orders promptly.

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Timbers and Lumber for Shipbuilding Purposes—II

By Horace Holden Thayer*

Continuation of a series of articles containing information regarding shipbuilding materials and their uses that is not readily obtainable from shipbuilding handbooks and other generally available sources. The articles are not intended to be a complete exposition of the subject but will be found to contain items of value to the classes of workers who have to deal with these materials from the materials point of view.

HAVING briefly considered in a general way the more important factors governing the selection and use of woods for shipbuilding purposes, the writer will present a few facts of interest that have come under his observation regarding the woods already mentioned and some others that have not yet been referred to.

Ash

The ash of particular value for use about a ship is White Ash, which is very strong, tough and elastic. The second growth Ash, which is the strongest and heaviest, weighs when seasoned about 44 pounds per cubic foot. Such articles as oars and boat hooks should be specified to be of best quality White Ash. It is a valuable wood for accommodation ladders, outside wood ladders generally and Jacob's ladders, also for wood gratings and grab rails. It is also used for doors of refrigerated rooms and the door casings. Other joinerwork uses for which this wood is particularly suitable are dressers, tables and benches, dish racks, drain, dough, chopping and bread boards, and stern and side light boxes.

Balsa Wood

Balsa is a Central American wood which is white, very soft, and of low density, though quite variable in its weight. Untreated pieces may weigh as little as ½ pound per board foot and from that on up to 2 pounds or more. It deteriorates rapidly after being cut, particularly in the wet season, unless specially treated. The treatment is given after the wood arrives in this country and prevents access of moisture to the fibres of the wood structure. It adds somewhat to the weight of the wood but the commercial product unless given an extra heavy treatment should not run over one pound per board foot. The owners of the encysting process figure their commercial product as weighing only about 10 pounds per cubic foot.

Balsa wood is approved by the U. S. Steamboat Inspection Service as the bouyancy element in life preservers and life rafts. On account of its light weight and good insulating properties it is also of value for cold storage insulation; and in some cases the total cost of the insulating work may be expected to compare favorably with cork blocks. Some shipboard refrigeration insulation installations of considerable size have been made during the past two or three years and at least one has been in successful operation for about six years. It will be of interest to learn how the life of this form of insulation compares with that when cork blocks are used. None of the installations as far as known to the writer has been in locations where surfaces with any considerable curvature had to be dealt with.

Beech

This wood is of interest mainly to New England shipbuilders for framing timbers and ranks with birch and hard maple. It weighs when seasoned about 44 pounds per cubic foot. The Forest Service does not consider that either Beech or Hard Maple has the lasting qualities of Birch for such parts of the construction as deadwoods, keelsons and framing about the upper part of the bilge. None of them can be recommended for the top timbers of frames.

Birch

The birch woods used for structural shipbuilding purposes are Yellow and Sweet or Black Birch. The physical and mechanical properties of the two are quite similar. They are of interest mainly to New England shipbuilders, and have been considered above in connection with Beech. Seasoned Yellow Birch weighs about 44 pounds per cubic foot, and Black Birch about 45 pounds. The latter is preferred to the former by some of the classification societies for keels, garboard and bottom planking and floor timbers.

Black Butt

This is an Australian wood and frequently reaches the West Coast markets under the name of "Iron Bark." It is used for the services referred to under Iron Bark and has given a good account of itself when used for rudder stocks of large wood vessels. It is somewhat inferior to and of shorter life than Iron Bark.

Brush Box

This is also an Australian wood and the above notes regarding Black Butt apply to it. It may be expected to have a longer life than Black Butt and very close to that of Iron Bark.

Chestnut

This is another wood of interest mainly to New England shipbuilders. Although it is a relatively long lived framing timber as regards decay, it is not as durable as regards wear and tear, and it does not possess the strength or holding power for fastenings of the other hardwoods nor even that of dense Southern Yellow Pine. It is apt to be wormy It weighs when seasoned about 30 pounds per cubic foot. It is not favored by the classification societies although its use may be approved in some locations with proper increase in scantlings (dimensions) over the more desirable woods. If some means of checking the blight are not discovered and used, this wood will soon be as extinct in this country as the dodo.

Cuban Pine

Cuban Pine or Slash Pine is a species of Yellow Pine found in the Coast regions from southern South Carolina to Louisiana. It resembles Longleaf Pine in being dense and hard, and weighs when seasoned about 45 pounds per cubic foot. It usually has more sapwood than Longleaf Pine.

Cypress

The only cypress wood of value for structural shipbuilding purposes is Southern or Bald Cypress. It weighs when seasoned about 30 pounds per cubic foot. The heart wood is exceptionally durable. Being found only in the South Atlantic and Gulf States, the structural timbers are of interest mainly to shipbuilders in those States. It contains a great deal of moisture, as has been previously noted and

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should not be built into the structure of a vessel until thoroughly seasoned.

Cypress is a swamp or lowland tree and the wood varies greatly in color; also in weight. The gulf coast cypress is usually redder in color than that grown farther north. Along the gulf coast the wood is generally called Red Cypress, farther north, Yellow Cypress, and that from the extreme northern range is sometimes called White Cypress. The "red cypress" is frequently claimed to be more durable than the "yellow cypress" and this claim has at times received classification society recognition; but the Forest Service has advised the writer that, based on the color of the heart wood, they have been unable to determine any difference in durability between red colored cypress and yellow colored cypress.

Bald Cypress for joinerwork is marketed under the name of white, yellow, red or black cypress, according to the color and weight, but these are all the one wood.

Cypress properly seasoned may be expected to receive classification society approval for such items as floor and frame timbers, aprons, deadwoods, hooks and pointers. During the recent war it received such approval for one member of a double frame, the other member being of Yellow Pine, this being more favorably considered by the classification society in question than a complete cypress frame. The writer is of the opinion that such mixed construction should not be adopted as the cypress does not react to strain and moisture conditions in the same manner as any other kind of wood alongside of it, and premature decay of the other wood may result.

Natural crook Cypress knees may also be approved but sawed knees of this material should not be used under any circumstances, as they have a marked tendency to split across.

Kiln dried Cypress is a valuable wood for interior joinerwork but it is apt to warp when used for outside sheathing and other outside work where swelling due to absorption of moisture cannot be accommodated. It is, however, frequently used for outside doors, windows, storm shutters, bucket racks, name boards, etc.

Kiln dried Cypress can also be used for calking wedges, stopwaters and plugs, but it is not as good for such service as White Pine. It can also be used as mold material.

Douglas Fir

This wood, more frequently in the east called Oregon Pine, is as has been shown, one of the two most valuable woods available to the shipbuilder in this country. It is a western wood and the strongest and heaviest wood comes from Washington and Oregon and elsewhere along the Pacific Coast. It weighs when seasoned about 34 pounds per cubic foot. The Douglas Fir from the Rocky Mountain States is inferior in strength and weighs about 30 pounds per cubic foot. The coast wood although having less strength than Southern Yellow Pine and less holding power for fastenings, is only about 13/16ths as heavy; and as considerable of the structure is interchangeable in the two woods, size for size, a wood ship built of Douglas Fir will carry more deadweight than the same ship built of Yellow Pine. Timbers of large size and long timbers and planking can be more readily obtained in Douglas Fir than Yellow Pine. In fact the timber schedules of some of the west coast wood ships would be very hard to duplicate in Yellow Pine. The wood has a tendency to check in seasoning from which Southern Yellow Pine is comparatively free.

Douglas Fir can be used for all of the woodwork in a wood ship except the rudder stock and treenails, and Douglas Fir root knees are available in large sizes and are among the best. Douglas Fir is the best decking material, all things considered, for both steel and wood ships. Old growth Douglas Fir joinerwork is serviceable, attractive and comparatively light, and for trim and built-in furniture when given a bright finish it makes a good substitute for the hardwoods that the west coast builders find it difficult to obtain.

The writer was advised by a west coast wood shipbuilder some years ago that there are three kinds of Douglas Fir timbers and lumber on the market—the red (young), the bastard (half grown), and the yellow (fully grown); that the bastard is the only kind valuable for ship timbers, the yellow having loose knots, shakes, etc.; and that the yellow is fine grained and good for joinerwork. Subsequent investigation from several sources has confirmed this. The young fir is usually of rapid growth and not sufficiently dense and the old fir is objectionable as timbers for the reasons stated. The old fir is of lighter weight, soft, easy to work and can be kiln dried with good results, while the young and bastard firs are hard and brittle when kiln dried. This variation with age in the characteristics of Douglas Fir emphasizes the value of the density rule classification previously referred to.

Elm

All varieties of this wood are tough and of long life when kept constantly wet, the Cork or Rock Elm being the heaviest, toughest, most cross grained, and best for shipbuilding purposes. Weights when seasoned run from about 35 to 44 pounds per cubic foot. The wood is of great value for the keel and keel shoe and bottom and bilge planking of wood vessels; and it has been frequently used to cover and protect from corrosion the bottoms of iron or steel vessels.

Eucalyptus

California Eucalyptus or Blue Gum is heavy, hard, tough and strong and therefore is occasionally used for the treenails or wood fastenings of wood ships. That this is not a good practice may be seen from the list of moisture content of woods previously given and from the shrinkage figures of the section of this paper dealing with treenails, which result from the relatively porous nature of the wood. The writer has been informed of one west coast ship which had to have its Eucalyptus treenails replaced by Locust before making a single trip. The wood is furthermore not very durable and checks and warps badly in seasoning. It weighs when seasoned about 54 pounds per cubic foot.

Greenheart

Greenheart is very hard and strong, and very long lived, and when seasoned weighs about 62 pounds per cubic foot. The supply comes from British Guiana. The Forest Service has found that as a beam or post it is 25 percent stronger and 50 percent stiffer than black locust, the strongest and stiffest of 130 North American woods tested by them up to 1916. It could well take the place with the east coast builders that Iron Bark takes with the west coast builders for rudder stocks of large wood vessels. It is, furthermore, highly resistant to the attacks of marine wood borers.

Gum

The gum woods grown in this country most frequently proposed for wood shipbuilding are the Black Gum and Red Gum of the Atlantic and Gulf States. They grow pretty well north and have been used to some extent by the wood shipbuilders of New England. These woods cannot be expected to have a long life except for the keel, garboard strakes and bottom planking, and as the woods are lock-grained and likely to twist out of shape in seasoning, they are of little value except for the keel and keel shoe. Their good points are that long lengths are readily obtainable, the wood is tough and has good holding power for fastenings, and iron or steel fastenings are practically incorrodible in it. Seasoned Black Gum weighs about 35 pounds per cubic foot and Red Gum about 34 pounds.

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HACKMATACK (see under Tamarack)

HEMLOCK

This wood is only of value for rough joinerwork, being light, soft, splintery and slivery. The Western Hemlock is harder and less splintery than the Eastern Hemlock. Both weigh about 28 pounds per cubic foot when seasoned.

HICKORY

Hickory is very heavy and exceedingly hard and tough, the true hickory weighing in the neighborhood of 50 pounds per cubic foot. It has most of the qualities of a good treenail wood and is often proposed for such service. It is, however, too porous, allowing water to seep through it when below the waterline, and subject to considerable change in volume between wet and dry conditions when above the waterline.

IRON BARK

Iron Bark or Australian Blue Gum has been previously referred to. It is a strong, long-lived, heavy wood that is shipped to the west coast markets principally for use for rudder stocks of wood vessels. It weighs when seasoned about 70 pounds per cubic foot. It is not easy to distinguish from the Australian Gray Gum, Black Butt and Brush Box which are inferior to it. Iron Bark is also of value for fenders wearing strips and similar service for which hard White Oak is used in the east.

LIGNUM VITAE

This wood is also an imported wood and is the ideal wood for propeller shaft stern bearings and other bearings under water. The wear is naturally much better when on the ends of the grain than when along the grain, and the wood should be ordered in edge grain slabs or in blocks from which the desired edge grain strips can be cut without excessive waste. It is very hard and strong, and weighs about 75 pounds per cubic foot. It is of value for sheaves of blocks, rollers, fairleads, mast and flagpole trucks, etc.

LIVE OAK

This wood is found in the South Atlantic and Gulf States and classes as a shipbuilding timber with Greenheart and above White Oak. It is the wood of which the old U. S. Frigates were largely constructed, some of which are still afloat and more would be if not accidentally or purposely destroyed. It is compact, fine grained, very strong and durable and weighs when seasoned about 60 pounds per cubic foot. It is approved by classification societies for all parts of the structure of wood ships including the rudder stock, knees and treenails. It is not generally available at reasonable prices. It does not take spike fastenings well but there is no difficulty in fastening with bolts or treenails. Unlike other oaks in this country it is free from acid.

LOBLOLLY PINE

This is a species of Southern Yellow Pine which is very variable in weight and strength, the light weight and rapid growth wood being of little value for structural shipbuilding purposes. It is difficult to distinguish from Longleaf Pine, but the adoption of the density rule quoted in the Grading section of this paper overcomes the difficulty and ensures the obtaining of suitable timbers. The weight when seasoned averages about 38 pounds per cubic foot.

LOCUST

The wood called Black Locust in some sections of the country and Yellow Locust in others, is exceedingly strong and hard and has little moisture when green and slight shrinkage from that to the seasoned condition. It weighs about 48 pounds per cubic foot when seasoned. It is mostly straight grained. These properties make it an ideal wood for the treenails of wood ships, also for dowels in scarfs, etc.

Honey Locust is sometimes proposed for treenails but this wood is lighter, brittle not so straight grained, and inferior for the purpose.

LONGLEAF YELLOW PINE

This is the principal Atlantic and Gulf shipbuilding wood and comprises the bulk of the Southern Yellow Pine timbers supplied under the density rule of the Southern Pine Association. It is straight grained, hard and heavy, weighing when seasoned about 42 pounds per cubic foot. The leaves are from 8 inches to 11 inches long.

Like Douglas Fir, Southern Yellow Pine can be used for almost all the woodwork in a wood ship. It is somewhat handicapped for such services as decking, partition bulkhead, joinerwork and masts and booms by its weight.

MAPLE

The structural maple wood is Sugar Maple, called Hard Maple or Rock Maple and it is of interest mainly to New England shipbuilders for framing timbers. It weighs when seasoned about 43 pounds per cubic foot. It is difficult to cut across the grain and occasionally has a wavy or bird's eye grain. It has previously been considered in connection with Beech.

Maple makes an attractive and serviceable flooring for such rooms as the social halls of passenger steamships. It is also of value for joiner trim and portable furniture.

NORTH CAROLINA PINE

This is the name given to Short Leaf Yellow Pine marketed from North Carolina and adjoining territory, mostly in the shape of joinerwork material.

NORWAY PINE

This wood is found in this country only in the North Atlantic and Great Lakes States. It closely resembles the lighter grades of Southern Yellow Pine, and weighs when seasoned about 34 pounds per cubic foot. It has not the strength or the life of dense Southern Yellow Pine, and when proposed for use requires increased scantlings over that wood. It is of value for masts and booms.

OREGON PINE (See under Douglas Fir)

OSAGE ORANGE

This wood is similar in weight, color, structure and other properties to Locust, and like Locust it is of value for treenails and dowels. More care has, however, to be taken to keep within the allowable limit of cross grain. It is sometimes called Bois d'Arc, being the wood from which the Indians made their bows. It is the heaviest of 130 North American woods tested by the Forest Service up to 1916, weighing when seasoned about 56 pounds per cubic foot.

PIN OAK (See under Red Oak)

PITCH PINE

This is a short leaf pine as regards its leaves, but is distinguished by a peculiarly rough, dark bark, and by the abundance of its resin. The wood resembles that of Shortleaf Pine and weighs when seasoned about 35 pounds per cubic foot. It does not take paint as well as the other yellow pines, but otherwise classes with them for shipbuilding purposes, subject to the standard grading rules.

Tar is obtained by distillation of the heartwood of this tree and pitch is the tar boiled down to the proper consistency. Hence the name of the tree. Turpentine is distilled from the sap of the tree.

Pitch Pine that has been bled during its growth is of a more uniform color than otherwise, and lighter weight. The

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writer has for years considered the bled timber to be inferior to unbled timber in strength and length of life and knows a number of men familiar with handling the wood who are of the same opinion. The Forest Service, however, does not consider that the bleeding has any marked effect on either the durability or strength of the wood.

Poplar

This is not a structural wood but is valuable for high grade interior joinerwork and for furniture which is to be painted. It weighs when seasoned only about 27 pounds per cubic foot. It is easily worked, has good holding power for fastenings, takes a smooth surface and forms a good background for the highest grade of painting.

Port Orford Cedar

This wood grows in a small coast region of northern California and southern Oregon and so is of interest mainly to the shipbuilders in that section of the country. It is a very good wood for planking on small boats and on account of its durability is frequently used for the double diagonal sheathing found on some types of large wood vessels between the frames and outside planking. The wood is straight and fine grained, easily worked and a superior joiner wood both inside and outside. It weighs about 31 pounds per cubic foot. It is a good wearing wood for such service as false decking.

Red Cedar

This is a West Coast wood and is not a structural wood except for canoes, rowboats and other small craft, being too soft and lacking strength. It is a durable wood and very light, weighing only about 22 pounds per cubic foot when seasoned, but is somewhat stronger and harder than the eastern White Cedar. It is of value for joiner sheathing and panelling where light weight is essential and also as mold material.

Red Oak

This is the family name of a considerable number of oaks, as may be seen from the table, none of which is found on or convenient to the West Coast. They are very inferior to the White Oaks and of comparatively short life when used above the light waterline. They are suitable for the keel and keel shoe. Weights when seasoned run from about 40 to 50 pounds per cubic foot. Some of these, such as Water Oak, have greater strength than White Oak and are proposed as substitutes for White Oak on that account; but they are of a porous nature and do not resist decay. Like the White Oaks they are apt to check considerably in seasoning, and are usually straight grained.

Redwood

This wood, also called Sequoia, grows along the upper half of the coast of California and a small corner of Oregon; but it has been so ably advertised in the east that it appears to be used as much by the Atlantic, Gulf and Great Lakes shipbuilders as by the Pacific Coast shipbuilders. It is not a structural shipbuilding wood, being relatively soft, low in strength and splits easily. The weight varies greatly in different parts of the tree, butt logs being often very heavy; it will average, however, about 26 pounds per cubic foot when seasoned. It is of value for canvas covered decks where strength is not a factor, also for joiner trim, inside sheathing and partition bulkheads. It is not the equal of Poplar or Port Orford Cedar for these purposes and is not a good exterior joinerwork wood. It is extensively used for patterns. The wood is long lived and increases in strength with age.

Rosemary Pine

This is a grade of Loblolly Pine which departs from the characteristic wide annual rings of that species and which in the east used to be considered the ideal wood for masts. There is no stand of this wood to be found but only scattered trees, which are not apt to run over 29 inches diameter at the butt with 22 inches of heart and 14 inches diameter 76 feet up with 7 inches of heart.

Shortleaf Yellow Pine

This is another species of Southern Yellow Pine which is inferior to Longleaf Pine but superior to the general run of Loblolly Pine. Like the latter it is difficult to distinguish from Longleaf Pine, but the adoption of the density rule previously quoted overcomes this difficulty and ensures the obtaining of suitable timbers. It weighs when seasoned about 38 pounds per cubic foot. The leaves are in groups of threes, and from 3 inches to 5 inches long.

Spruce, Common

The Spruce woods of principal interest to shipbuilders are Sitka Spruce, which is a Pacific Coast wood, the White Spruce found in the region of the Great Lakes, the New England States and the Appalachian Mountains and the Red Spruce found in the two latter. The wood is straight grained and weighs when seasoned only about 26 pounds per cubic foot for the western wood and 28 pounds for the eastern wood. It is short lived, relatively weak and has a tendency to excessive shrinking and swelling with changes in weather conditions. It is not a good structural or joiner wood.

On account of its light weight and other qualities it is valuable for hold ceiling and flooring in steel vessels, hatch covers, portable wood fenders, booms and gaffs of sailing vessels, topmasts and flagpoles.

Spruce has no odor and does not taint foods. It is therefore a very desirable wood for the lining of refrigerated rooms, shelving in steward's stores, galley table tops, etc.

Spruce, Bay Shore

This is a superior wood to the above that grows along the shore of the Bay of Fundy. It is stronger, longer lived and a better structural wood in every way. It is available to the New England builders. When the timbers can be proved to be of first quality Bay Shore Spruce they are apt to receive classification society approval for all parts of the frames of wood ships, apron, deadwoods, transoms and other members.

Tamarack

This wood, which is also called Hackmatack and Eastern Larch, and called Juniper in Maine, grows in the New England, North Atlantic and Great Lakes States. It is coarse and splintery and not of general structural utility, and weighs when seasoned about 37 pounds per cubic foot. Being long lived, hard and with good holding power for fastenings, the natural crooks make excellent knees.

Teak

East India Teak is the premier shipbuilding wood, but its expense has put it out of the running for the present day main structural members or planking. It weighs when seasoned about 45 pounds per cubic foot. It is very long lived, strong, easily worked, does not crack or alter shape when once seasoned and takes a beautiful polish. These qualities warrant its use in many cases for calked decks, houses, rails, planksheers of decks and erections, deck machinery foundations, etc. It is also used for binnacles and other similar service.

Teak like Red and Black Gum has the property of preserving iron or steel fastenings embedded in it.

Water Oak (See under Red Oak)

White Cedar

Northern White Cedar, or Arborvitae, which is found in the Eastern and Great Lakes regions, is a very soft, light

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weight wood, which has found some favor in the building of pleasure craft. Planking of this material will resist decay for the usual life of such vessels but it is easily scarred and the edges broken by ice or other objects with which the vessel may come in contact. The weight of the seasoned wood is about 22 pounds per cubic foot.

There is a species of White Cedar, called also Swamp Cedar or Juniper, which grows along the coast from Maine to northern Florida and thence westward to the Mississippi. It is of no value for structural purposes in shipbuilding.

WHITE OAK

This is the family name of a number of oaks, as may be seen from the Table, all of which are good structural woods and also valuable for joinerwork finish and furniture. None of them is found on or convenient to the west coast. They weigh when seasoned from about 45 to 48 pounds per cubic foot. The wood is generally straight grained. It is apt to check considerably in seasoning. White Oak cut during the warmer months seasons more rapidly and is subject to greater checking than when cut in the winter, hence it is better to cut the wood in the winter.

All the White and Red Oaks contain gallic acid which corrodes metal fastenings and these fastenings should therefore be heavily galvanized. The acid acting on steel produces an ink which blackens the wood.

The White Oaks, except Chestnut Oak, have the large pores in the springwood densely plugged up, whereas in the Red Oaks and in Chestnut Oak these pores are more open. Hence the inferiority of the latter to the former and the decay resisting qualities of True White Oak, Burr Oak and Post Oak.

True White Oak is the most important of the group and grows in practically the entire eastern half of the United States.

White Oak is of particular value for the framing of wood ships and such special service as the rudder stock, stem and stem gripe, stern post and rudder post, keel shoe and keel, shaft log, horn timbers,. fenders and wearing strips, rails and chock rails, hatch carlins and staving and bitts.

White Oak from northern Michigan or a similar locality is superior to southern white oak and should always be specified for such services as rudder stocks where particularly tough material with good torsional strength is required.

On account of the tendency of all oaks to check they should not be used in such service as house sills exposed to the weather, where the wood will usually be dry and yet is required to be watertight when there is any water about.

WHITE PINE

There is an eastern White Pine and a western White Pine, the latter being somewhat stronger and heavier, though both are relatively soft, light weight woods, of little value for structural shipbuilding purposes. The eastern wood is a very fine joinerwork wood; but the western wood is available only in short lengths and small dimensions, and even these are hard to get in the clear grades. The eastern wood weighs about 27 pounds and the western about 29 pounds per cubic foot.

The eastern White Pine is not used as much on ships as in former years on account of its increasing scarcity and high price. It makes a good deck when not subjected to rough usage. It is the ideal material for molds.

Seasoned White Pine swells greatly when wet and this wood is therefore extensively used for wedges for calking the ceiling of wood ships, the planking of floating drydocks, etc., and such wedges are a staple article of commerce. It is also used for stopwaters in scarfs and elsewhere, for tongues to ensure the watertightness of joints in such construction as built up stern posts, and for plugs over bolt heads or where a hole is drilled for a fastening and the fastening cannot be put in.

OTHER WOODS

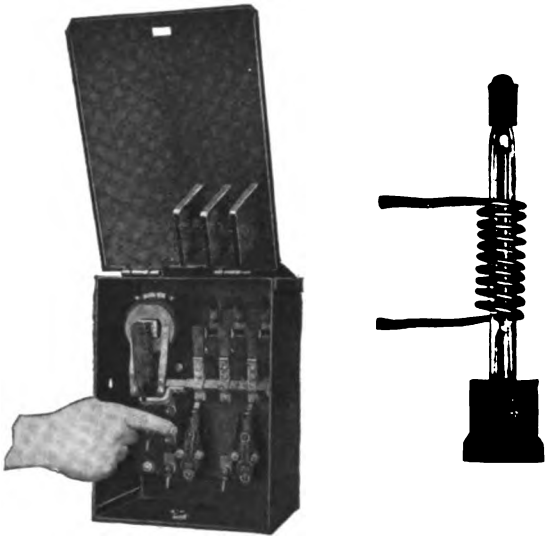
There are many other woods which find their way into ships by reason of their availability or by reason of having special artistic or other qualities that appeal to the experienced ship joiner; but their uses are in the main not peculiar to the shipbuilding field and do not merit detailed consideration here.

(To be continued.)

Automatic Starter for Squirrel Cage Motors

A NEW automatic starter for small squirrel cage motors which allows a large starting current for several seconds but at the same time gives protection against burnout troubles has been developed by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Two mercury overload relays mounted below the contact fingers, shown in the illustration, take the place of fuses and allow momentary overloads and overloads as high as 25 percent for a limited period without injury to the motor.

The overload relay consists of a glass tube carrying a mercury column which forms a part of the pilot circuit of the magnetic switch coil. A portion of this column is surrounded



Automatic Starter and Mercury Overload Relay

by a heating coil or thermal element. This element is in series with the motor circuit and is heated in the same proportion as the motor windings. Excessive current passing for too long a period heats the coil, causes the mercury to boil and the vapor to pass up into a chamber at the top of the tube. This action breaks the liquid mercury column and opens the circuit of the magnet coil. As this coil is de-energized, the contact fingers drop away and disconnect the motor from the line. After such an interruption, the mercury cools down, becomes liquid again, drops back into the tube so that the pilot circuit to the magnet coil is complete when the control button is depressed.

As the functioning of these overload relays depends upon the temperature at which mercury will boil, it is evident that the current required to operate the relay increases with the decrease in the temperature of the surrounding air. In other words, if the motor and the starter are installed in a cool location, the relay permits a greater starting current or a higher overload than if the temperature of the surrounding air were higher. Likewise, if the motor and starter are located in an unduly hot place, the mercury relays will act in the place of a thermo-couple.

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Motorship Building in Europe

By Our Special London Correspondent

From the point of view of technical interest the four cycle engine now seems to be losing ground in Europe and the two cycle type has come much to the fore. This does not imply that more motorships equipped with the latter class of machinery are being built than are fitted with four cycle plant, but that engineers and shipbuilders are showing more actual interest as the results obtained with various designs of two stroke Diesel motors become known.

THE Doxford and Cammell Laird two stroke engines have done all that was claimed for them, the performance of the Still combined steam and oil engine appears to have been satisfactory, and just recently excellent results have been recorded from the first really important Sulzer engined motorship that has been constructed in Europe. A number of smaller craft fitted with Sulzer engines have been built but the completion at Armstrong's yard on the Tyne of the 6,500-ton motor tanker *Conde de Churruca* affords the first opportunity for engineers and shipowners to gain some idea of the suitability of the Sulzer two cycle engine for the propulsion of large ships. The trials were run at the end of August and the beginning of September, and in view of the fact that many engineers consider this type to be the best on the market, a few of the technical features which struck the writer with some force at the time of the trials may be mentioned, for there is no doubt that unusual originality has been shown by the designers of the Sulzer motor.

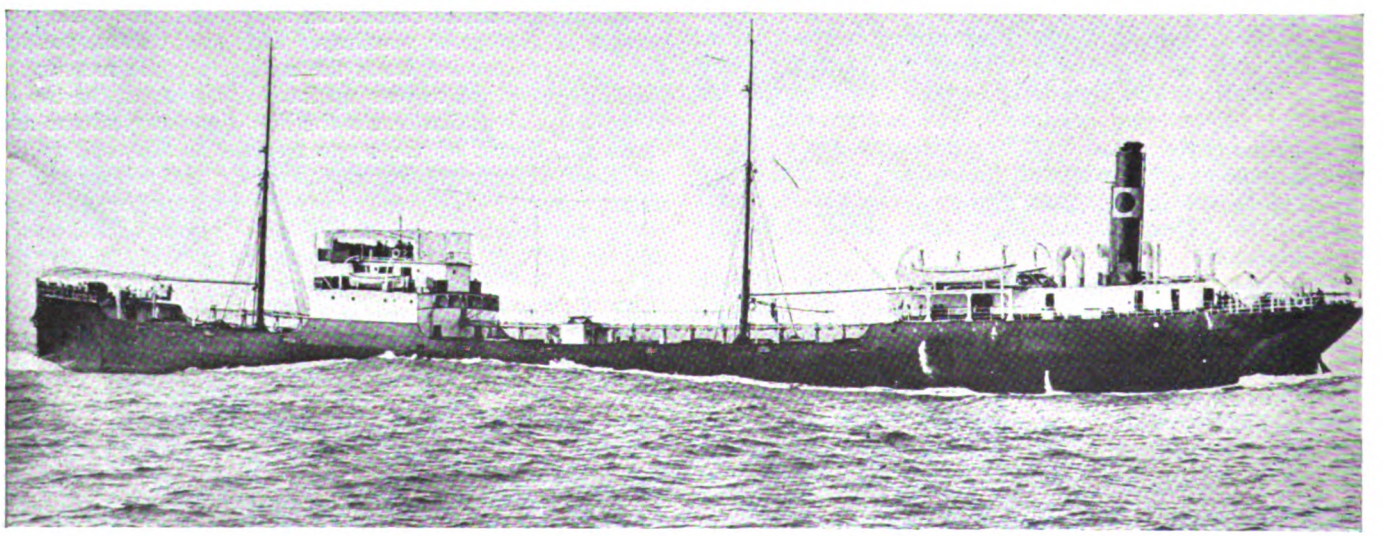
Each of the engines develops 1,250 brake horsepower at 100 revolutions per minute, this being equivalent to 1,750 indicated horsepower. There are four working cylinders 23⅜ inches diameter by 37 inches stroke and the ordinary scavenging pump and three stage air compressor are driven off the crank shaft. All the accessory pumps required while the ship is at sea, such as the bilge pump, circulating water pumps for piston and cooling water, lubricating oil pumps, etc., are driven off the main engine, so that no engine room auxiliary is required when the ship is under way. This is quite different from the arrangement in all Burmeister and Wain engined ships as well as in many other types where the auxiliary pumps are driven by electric motors and the main engine operates nothing but the three stage air compressor. The Sulzer arrangement is similar to that adopted in steamers and for this reason will no doubt appeal to most marine engineers of the old school.

For the first time, so far as the writer is aware, it is proposed to operate the engines of this motorship on boiler fuel oil and upon the results achieved a good deal depends. If for engines of this type it can honestly be claimed that they will run on boiler furnace oil costing only about two-thirds as much as Diesel fuel commonly used in four cycle motors, it is clear that the two cycle type will find increasing favor among shipowners, more particularly as fuel oil will always be easier to obtain than Diesel oil.

Control Station on Top of the Engine

One of the novelties in the Sulzer engined ship is that the control station has been arranged right at the top of the engine, the main object being to eliminate much of the gear that is otherwise necessary. In the reversing mechanism, instead of the camshaft being moved bodily, there are the usual side by side cams but each valve lever is provided with two rollers on a forked arm, one of which can be brought in contact with the ahead cam and the other with the astern cam according to the direction of rotation required. One of the claims of this arrangement is that it also enables the reversing wheel, which carries out the operation to control the lift of the fuel valve needle when the engine is running. At low speed, therefore, not only is the amount of fuel controlled but also the lift of the valve, this being an undoubted advantage for slow running.

Chief among the claims made for the Sulzer engine is that it is immune from the possibility of cylinder covers being cracked and, as is well known, this has always been one of the great difficulties in connection with two cycle engines. The reason for this immunity is that there is only one hole bored centrally in each cylinder cover, this being for the valve cage which contains both the fuel valve and the starting air valve. As the trouble with cylinder covers has usually been put down to the number of holes bored in them, the makers' claim in this case appears to have some justification.



Motorship Conde de Churruca, Built by Armstrong Whitworth and Company

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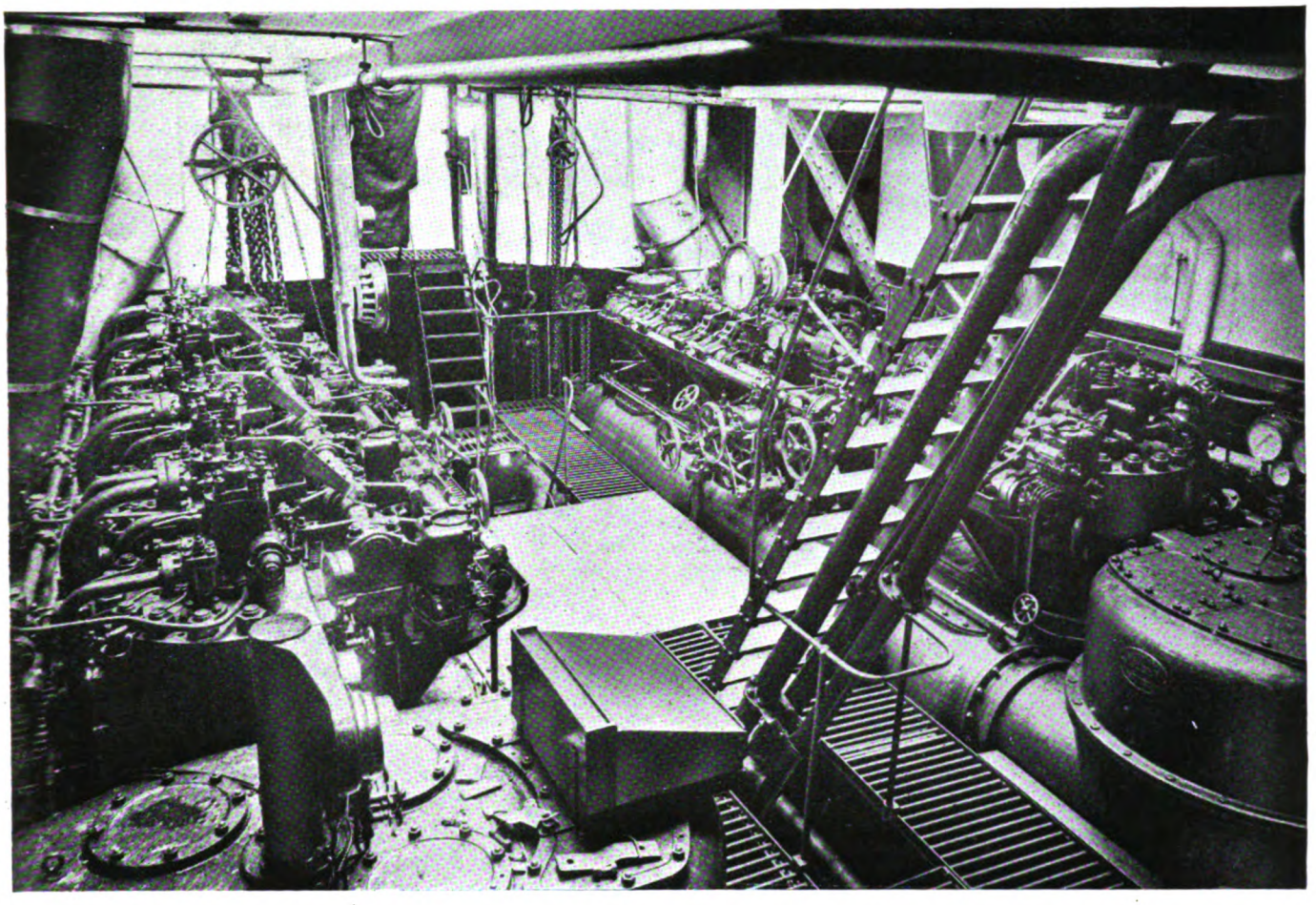

The Tops of the Two 1,250 Brake Horsepower Sulzer Engines in the Motorship Conde de Churruca, Showing the Engine Controls in an Unusual Position

Special Features of the Sulzer Engine

There are several other points in the design of the new Sulzer motors that will interest the engineer. Crosshead lubrication, one of the problems in two cycle engine design, is effected by a special pump at a pressure of 300 pounds per square inch although the lubrication of the rest of the engine is practically only by gravity. A neat device in connection with the starting air valve allows the starting air on the exhaust stroke of the piston to be delivered back into the scavenging trunk, the result of which is to relieve the pressure in the cylinder and also to charge up the scavenging air, so that, when the engine starts firing, there is already a pressure in the scavenging trunk.

Trouble with air compressor valves appears to have been overcome by a new design, with which they are set in a conical cage, that can be taken out bodily by unscrewing two or three bolts. Instead of having piston valves in the scavenging pump, these are of the disk type and the air is not drawn into the scavenging cylinder direct from the engine room but passes through the large wooden chamber, several feet cube, perforated by holes. An excellent silencing effect is obtained and the exhaust is also comparatively silent.

Comparative Fuel Consumptions of Diesel Engines

From these brief details it will be seen that the *Conde de Churruca* is a ship of exceptional interest and in the writer's opinion no point is of more importance than that of the possibility of running the engines on boiler furnace oil. Success in this direction may have more far reaching results than appear likely on the surface.

There is a surprising similarity between the fuel consumptions of various types of marine Diesel engine now being built as the following figures will show. These are based upon actual test results and apart from the Still and Cammell Laird engines it will be seen that there is little to choose from them and the difference between two cycle and four cycle consumptions is not so great as had been thought. The Cammell Laird engine certainly appears to give excellent results but it should be added that this test, which is the only one which has been carried out, was for a period of only 12 hours and it may be that circumstances were especially favorable. At any rate it seems difficult to understand why this type of motor should have a higher efficiency than the four cycle engine. The Still combined steam and oil engine has been subjected to very long tests at Scott's works and the figure quoted appears to have been definitely established as correct.

The results obtained are as follows:

Type of engine	Pounds per b.h.p.hr.
Burmeister and Wain (four cycle)	0.40
Vickers (four cycle solid injection)	0.42
North British (four cycle)	0.42
Sulzer (two cycle)	0.42
Doxford (opposed piston)	0.43
Cammell Laird (opposed piston)	0.39
Still (combined steam and oil)	0.36

Motorship Building Activity

In spite of the very unsatisfactory position of the shipbuilding industry in Europe there is quite a large amount of activity in connection with motorships. During the past few weeks a new 14,000-ton cargo vessel has been launched for the Royal Mail Steam Packet Company at John Brown's

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yard on the Clyde, the first motorship for shipowners and shipbuilders, while the *Hauraki*, a 11,000-ton cargo vessel for the New Zealand trade, was launched at Dennys' for the Union Steamship Company.

NORWEGIAN MOTORSHIPS

The largest vessel ever built in Norway, the *Handicap*, has just been put in the water at Stavanger. She is a 9,000-ton ship to be equipped with 2,700 brake horsepower Sulzer engines and further activities in Norway include the completion of the Bergen Steamship Company's first motorship and the placing of a new order by Fred Olsen for a 7,000-ton cargo boat.

The Rotterdamsche Lloyd has just acquired a motorship completed at Burmeister and Wain's yard and will take delivery in October, while in the same month the first motor passenger ship ever built, the *Domala*, belonging to the British India Steam Navigation Company, will run her trials.

With the remarkable reduction in the cost of steel, the settlement of the joiners' strike and the reduced shipyard wages, shipbuilders are hoping that, soon, orders for new tonnage and especially for motorships will become more plentiful.

Full Diesel Engine of New Design

A FULL Diesel four-cycle engine, recently produced by the Lombard Governor Company, Ashland, Mass., embodies special features of cylinder construction which permit easy access to all moving parts, and the ready removal of the piston and shaft whenever necessary. The engines are of the heavy duty type built in two-cylinder sizes 9½ inches by 13½ inches, and 13 inches by 19½ inches, and in multi-cylinder combinations of 2, 3, 4, 6 and 8, giving a range of from 60 to 500 brake horsepower.

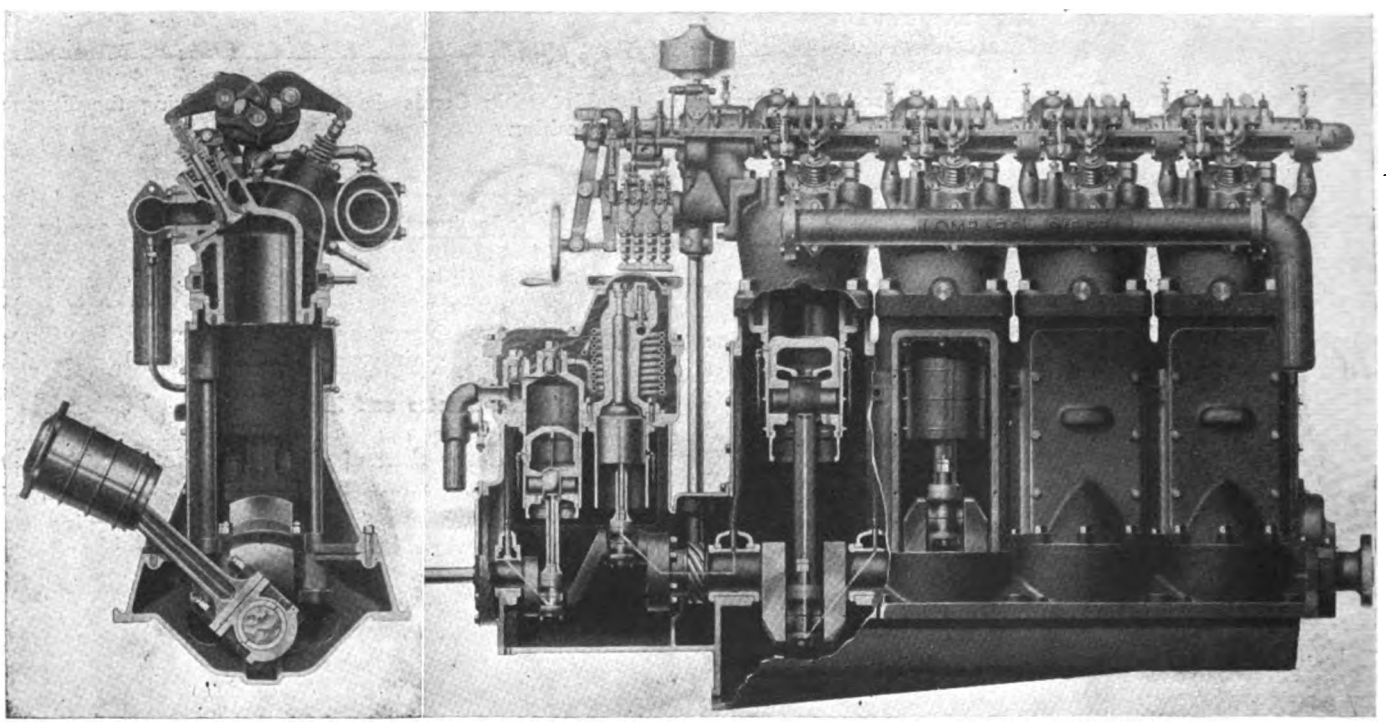
The cylinders are mounted in a large waterbox and are designed with removable skirt sections bolted to the bottom. With the crank on the bottom center, and the skirt detached from the cylinder casting, any piston with its connecting rod can be swung forward through the crank case door opening without removing the cylinder head, disconnecting the crank pin box, dismounting the valve gear or otherwise disturbing adjustments which it is desirable to preserve.

Oil is fed to the engine under pressure, which ensures thorough lubrication to all parts. The lubrication system includes filters and coolers so that the oil may be used repeatedly.

The air compressor is a balanced duplex design with cranks at 180 degrees.

ENGINE FRAMING

The frame sections which inclose the crank case are arranged to support the weight of the engine, while four heavy steel tie rods which extend from each cylinder to the main bearing pads within the bedplate carry the working load and relieve the frame from all tensile stresses. The removal of frame housing doors and tie rods along the front or air intake side permits rolling the main crank shaft out in the space directly alongside of the engine without dismounting the cylinders or disturbing the valve gear. All valves on the engine open outward and are readily accessible.



Sectional Views of Lombard Engine, Showing Accessibility of Reciprocating Parts Through Front Crank Case Door Openings

Developments in Marine Insurance

(*Concluded from page 732.*)

treal is located five hundred miles from the ocean on a river subject to heavy fogs involving strandings and collisions, and, furthermore, vessels having arrived at the mouth of the St. Lawrence must encounter the perils of ice and fog off the Newfoundland coast before reaching the safer regions of the Atlantic. It is estimated that it would cost $252,728,000 to construct the proposed all-water route. Undoubtedly it would mean much for Canada, but Montreal would always suffer by comparison with New York, from the standpoint of an available port, because it has to be closed from December 1 to the middle of April; which means the likelihood of inefficiency in a labor population that must be deprived of shipping activity for five months of the year.

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General Cargo Transferring Speed Per Linear Foot

Material Handling Devices and Ample Space Prevent Delays; Wharfboats Utilized in Some Places

As derived from a study of the records of many inland and ocean port terminals, extending over many years, it was found that there were transferred, where mechanical or other modern facilities had not been installed, about 125 to 150 tons per lineal foot per year. Where cranes and other machinery and co-ordinating railway tracks were provided, this 150 tons per foot was increased to 450 to 500 tons per foot annually.

Since these figures were recorded, due to still better facilities, whereby the flow in and out of freight in the sheds and on the open quay has been made more constant and uniform by machinery supplementing the cranes, these ton foot figures have been increased.

These were the average figures of the cargoes for all the port quay and pier frontages for all the year, and not the results of special tests. Part of the time there were no vessels berthing and at other times vessels two deep were waiting to obtain a place alongside the quay or pier wall. The totals being derived from many separate and diverse locations give a fair average for estimates. These figures were derived from average commercial ports and not from those where there might have been special difficulties or where there was a great rise of water, very high banks or other delay producing conditions. The rail coordinating tracks were only a few feet above the water level and the direct transferring between water and rail caused little loss of time.

For each six hundred feet, lifting directly by cranes from vessel to shore and the reverse movement, were transferred from 90,000 tons without improvements, to 300,000 tons per year with improvements. The port of New York being deficient in mechanical facilities has averaged about 150 tons per linear foot, and during past years the above average has been true of San Francisco.

Excess Lineal Frontage Needed

It is estimated that a prosperous terminal of the large cities should have facilities provided for at least 1,000,000 tons per year. In order not to delay the barges or other vessels there must be an excess lineal frontage as at certain periods there will be a large number of vessels to discharge or receive cargoes, and these must not be delayed. Improved and ample facilities are provided to prevent such delays of the vessels.

From the above figures, however, it can be determined what the total frontage must be including the excess to provide for the usual conditions of arrivals of vessels.

At 150 tons per linear foot for 500,000 to 1,000,000 tons minimum there would be required from 3,500 to 7,000 linear feet, at 500 tons per linear foot there would be required from 1,000 to 2,000 linear feet.

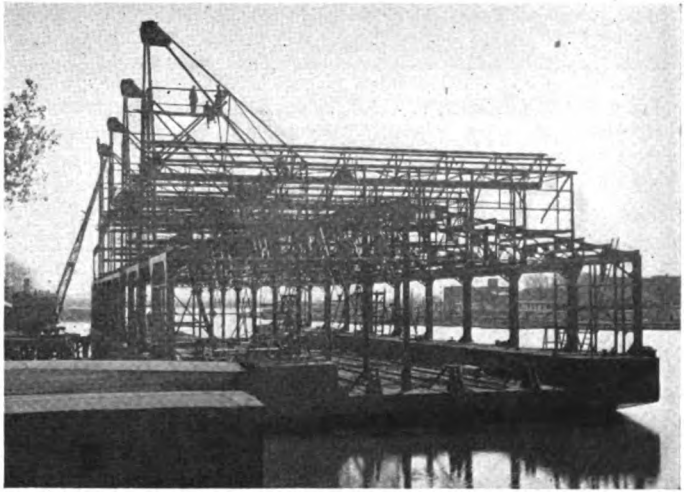
Where there are quick-acting cranes, one every 62½ feet, as at Hamburg, transferring directly from the top of the quay, or shed, into the vessel by one movement and no rehandling, even though the bank may be sixty feet or even more in height, there can be attained 500 tons per linear foot. The length of the ropes in hoisting is no more than into or from ocean general cargo vessels along the Atlantic Coast where the distance from the bottom of the hold to the top of crane jib is fully equal to as much as the 60 foot banks, and the figure of 500 tons was largely derived such cargo-ship transferences.

If, however, there are to be delays in the movements in and out, that is, congestion points due to limited assorting and distributing areas, then there would be required at least 4,000 feet, which includes the excess which experience has found necessary. For outbound freight, due to the advent of the motor dray which must come near the outbound vessel, more space than formerly must be provided.

Wharfboats

In some places, as per the above photograph more wharfboats are being provided. Without criticism, but applying the above rules, there are deduced the following facts:

These wharfboats are only 230 feet long, 75 feet wide and 21 feet in depth. For a standard terminal they appear too short, too narrow and it seems as though there must be congestion. The center of the boat is occupied with three



Wharfboat

railway tracks with narrow platforms on each side. These railway tracks are connected by means of aprons and floating bridges to the other tracks on the shore. As the variation in the height of the rivers may be fifty feet or more, varying according to the flood stages, there are times when the transfer speed will be greatly reduced.

The cargo handling equipment consists of four electrically driven telphers, each having a lifting capacity of two tons at 150 feet per minute, and a traveling speed of 300 feet per minute with an outreach of 40 feet over the offshore side of the wharfboat.

To transfer 1,000,000 tons of freight per year by means of wharfboats there would be required about 15 such wharfboats, providing for delays, congestion and unoccupied berths.

The probable cost of these wharfboats, aprons, bridges, accessories and shore works with connections would probably be not less than $5,000,000.

With the quick-acting cranes giving direct transference from car to barge the cost for all appliances with equivalent results would probably be less than one-fourth, the vessel detention about one-third, and the operating costs, including interest and maintenance should not exceed one-fourth.

If the tonnage be less, the above proportions would be about the same.

It seems as though there would be considerable congestion due to constricted areas on the wharfboat.

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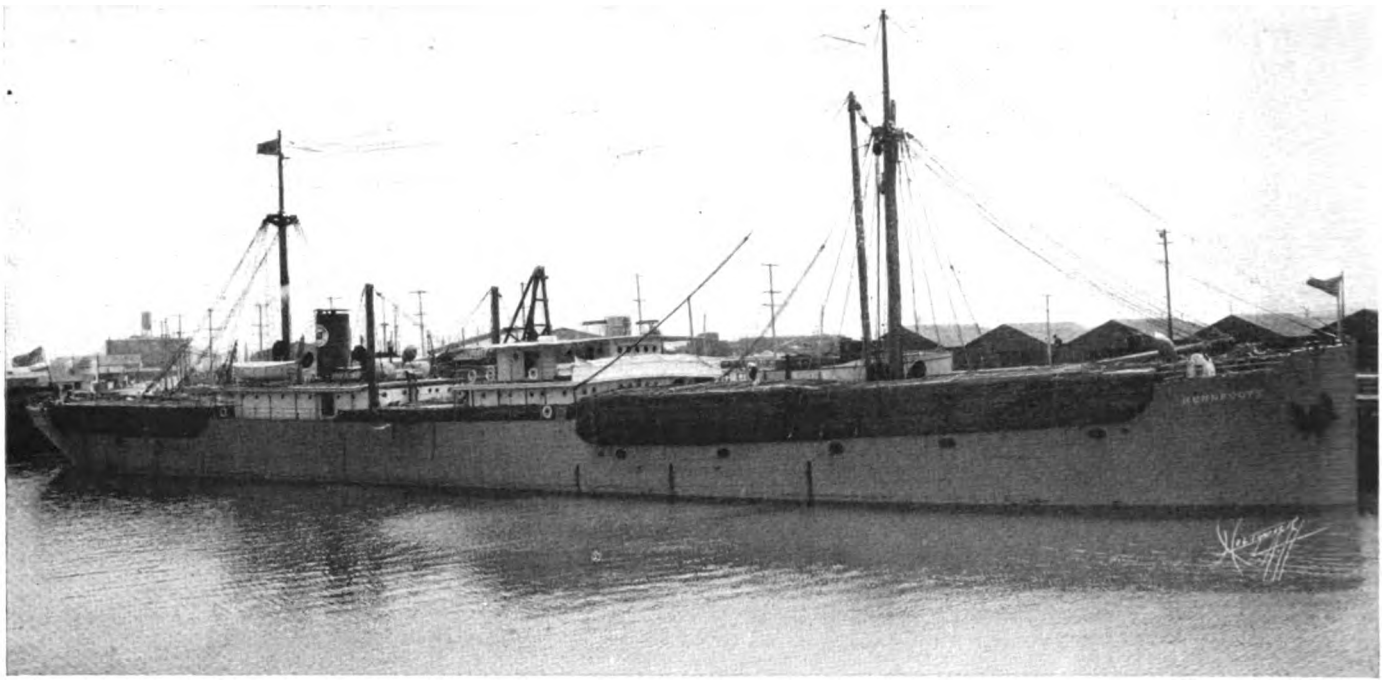

Motorship Kennecott, of 6,500 Tons Deadweight Capacity, Built at Tacoma Plant of Todd Shipyards Corporation and Engined with Two 1,200 Indicated Horsepower McIntosh & Seymour Diesel Engines

Performance of the Motorship Kennecott

Largest American-Built Motorship Covers 15,000 Miles in Six Months With No Expenditures for Repairs

By Frank Walker*

CONSIDERABLE interest has been aroused by the remarkable performance of the new 6,500 deadweight ton steel twin screw motorship *Kennecott*, built by the Tacoma, Washington, plant of the Todd Dry Dock and Construction Corporation for the Alaska Steamship Company, whose headquarters are in Seattle and from which port they have for many years operated a fleet of steamships.

This vessel is built under special survey of the American Bureau of Shipping, being granted Class A-1. Her general dimensions are: Length, 360 feet overall; beam, 49 feet, 6 inches; load draft, 22 feet.

The main propelling machinery consists of a twin installation of 1,200 horsepower six cylinder reversible four cycle full Diesel marine oil engines built by the McIntosh & Seymour Corporation, Auburn, N. Y., and driving twin propellers at a maximum speed of 140 revolutions. Photographs of these engines were published on page 633 of the August, 1921, issue of MARINE ENGINEERING.

AUXILIARIES ELECTRICALLY-DRIVEN

All auxiliaries both deck and engine room are driven by electricity, energy for this purpose being supplied by two 75 kilowatt General Electric generators, each coupled with a two cylinder 100 horsepower McIntosh & Seymour full Diesel engine. Each of these auxiliary engines is fitted with an air compressor, the discharges of which are connected to a compressed air main which is used to fill the air bottles or to supply the injection air. By this means air for starting the main engines is obtained in a few minutes after either of the auxiliary engines is started.

The *Kennecott* was launched at Tacoma on January 6, 1921, after which the machinery was installed and on March 17 a trial trip was run on Puget Sound. During the trials, which were made with the vessel light and included exhaustive maneuvering tests, a speed of 12.8 knots was easily maintained, although the specified contract speed was 11 knots.

MAIDEN VOYAGE SHOWS FUEL ECONOMY

Upon being delivered to her owners the *Kennecott* was loaded with lumber, taking 3,500,000 feet, and on her maiden voyage made the run from Bellingham, Wash., to San Pedro, Cal., in four days and five hours. During this voyage she used exclusively the same fuel oil as is burned under the boilers of the company's steamers. Before injection, however, this oil is heated by means of coils contained in a specially designed exhaust silencer. After heating, the oil passes to the day tanks for consumption.

On her first day's run she logged a distance of 292 nautical miles, averaging a speed of slightly over 12 knots. The consumption of oil was 65 barrels, 16 degrees Baumé, the cost of this fuel being $1.78 per barrel—decidedly a low fuel consumption per ton mile. This day's run, however, was in calm weather; on the second day out the vessel averaged approximately 10.5 knots against a strong head wind and sea, consuming the same amount of oil.

After discharging her cargo at San Pedro she returned light to San Francisco, making the run of 335 miles in 1 day 6 hours and 45 minutes. Here approximately 700 tons of freight was loaded and she then proceeded to Seattle via Victoria, B. C., covering the 742 nautical miles in 2 days 16 hours, averaging 11.5 knots.

(*Concluded on page* 782.)

*Marine surveyor, consulting engineer and naval architect, Seattle, Wash.

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Questions and Answers for Marine Engineers

Inquiries of General Interest Regarding Marine Engineering and Shipbuilding Will Be Answered in This Department

Conducted by James L. Bates

This department is maintained for the service of practical marine engineers, draftsmen and shipbuilders. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Propelling Machinery Design Problem

Q. (1137).—It is proposed to make a change in the steam propelling plant on a twin screw vessel, fitted with two small watertube boilers with a working pressure of 200 pounds per square inch, two triple expansion engines with cylinders 8 inches, 13 inches and 21 inches in diameter and 16 inches stroke, each of approximately 140 horsepower. What would be the size of two compound engines (diameter of cylinders for 16-inch stroke) to replace the above engines to operate the vessel at a speed of 8 knots, using a steam pressure of about 150 to 160 pounds per square inch in a single Scotch boiler? Also what would be the size of the boiler (diameter, length and horsepower)? Please show method of computation for above engines and boiler. Also please suggest some reliable text-books giving computations of this kind.

A. (1137).—The specific information as to sizes, power, etc., could be given only after a thorough investigation of the subject, based upon a full knowledge of all the factors involved. Such an investigation, while not considered practicable for these columns would, if undertaken, be in outline about as follows:

(a) A study of the form and resistance of the hull and appendages and the derivation of curves of effective horsepower therefor.

(b) A study of the conditions under which the propellers are to work and the fixing of the principal characteristics for the propellers.

(c) The fixing of the principal features of boilers and engines.

Form, Resistance and Power

There are so many different factors which enter into the resistance of the ship's hull that no simple formula can be expected to give very close results for vessels of different types at varying displacements and drafts. Mr. E. M. Bragg, in the section on Ship Forms and Power in the "Marine Engineer's Hand Book" by Sterling, page 1025, gives a formula which he states is fairly satisfactory in practice. This formula is

$$I.H.P. = (D \times V^3) \div C\sqrt{L}$$

D is the displacement in long tons.
V is the speed in knots.
L is the length between perpendiculars and
C is a factor, information relative to the value of which is also given.

The best method of estimating effective horsepower known to the writer is that described by Admiral D. W. Taylor in "Speed and Power of Ships." This method takes into consideration the effect upon resistance of the principal dimensions of the vessel and their relations one to another as well as that of the prismatic or longitudinal and midship section coefficient. It furnishes a means of deriving a very accurate curve of effective horsepower covering the entire speed range contemplated provided the form of the vessel in hand is closely similar to that of the model upon which Taylor's data are based. A careful study of the entire book is necessary in order to obtain a proper appreciation of the subject. For those portions most vital to the actual derivation of the power curves, see Figs. 41, 78 and 81 to 120 inclusive, also table X, all in Volume II, Tables and Plates.

Certain classes of vessel do not usually fall within the limits covered by Taylor's investigation. Among these are full cargo carriers, tugs, etc. A method applicable to such types is described in the "Marine Engineer's Hand Book" by Sterling, pages 1013 to 1027 inclusive.

The effective horsepower, as above described, is for the bare hull; that is, it does not provide for the resistance of appendages, such as bilge and docking keels, rudders, propeller shafting, struts, etc. Therefore, the effective horsepower, bare hull, must be increased by a percentage to allow for the appendage effect. For the values between which this percentage varies, depending upon the character of the appendages, see "Screw Propellers for Hydraulic and Aerial Propulsion" by Admiral Dyson, pages 26 to 30.

The Propeller

Admiral C. W. Dyson, in "Screw Propellers for Hydraulic and Aerial Propulsion," discusses the problem of propeller design in detail. A condensed discussion of this subject by the same author may be found in pages 1028 to 1076, "Marine Engineer's Hand Book" by Sterling, previously referred to. The characteristics of the propellers selected must be such as to develop the required thrust at the designed speed while working behind the hull contemplated, all at a reasonable efficiency.

Boilers and Engines

An up-to-date discussion of the principles underlying engine and boiler design may be found in "Marine Engineer's Hand Book," pages 821 to 837, relating to the development and determination of size of engines and pages 837 to 877 relating to the proportioning of engine parts. Pages 877 to 918 relate to valve gear pumps, piping and fittings.

The fixing of the type and size of engines and auxiliaries will make possible an estimate of the steam which the boilers must furnish. Pages 343 to 358, "Marine Engineer's Hand Book," cover the subject of general boiler design, while pages 359 to 375 give data relative to dimensions and weights for certain commercial types of boiler.

Taylor's "Speed and Power of Ships" is published by John Wiley & Sons, Inc., New York City, as is also Admiral C. W. Dyson's "Screw Propellers for Hydraulic and Aerial Propulsion." Sterling's "Marine Engineer's Hand Book" is published by the McGraw-Hill Book Company, Inc., New York City.

Metacentric Height of Hopper Barge

Q. (1134).—A hopper barge of box form is 200 feet long and 40 feet broad, the hopper being the amidships portion 50 feet long. When the hopper is empty the draft is 10 feet and the center of gravity is 15 feet above the keel. What is the metacentric height (1) when the hopper is empty, (2) when the discharge portion is open, (3) when the hopper is filled to a height of 10 feet with mud of specific gravity of 2.

A. (1134).—From the wording of your question, it is possible to assume that the hopper space occupies the entire midship portion of the barge. As it materially simplifies the actual work of finding the draft, metacentric height, etc., in certain conditions, this assumption has been made. It has also been assumed that all water is salt of 35 cubic feet per ton, that the mud in part (3) is $\frac{35}{2}$ or 17.5 cubic feet per ton and that no allowance for structure is necessary.

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PART (1) HOPPER EMPTY

Metacenter above base = V. C. B. + B. M. =

$$\tfrac{1}{2}\text{ draft} + \frac{\text{Inertia water plane}}{\text{Volume of displacement}} =$$

$$5 + \frac{(40)^3 \times 200}{12 \times 200 \times 40 \times 10} = 5 + \frac{40 \times 40}{12 \times 10} = 18.33 \text{ feet}$$

Height of center of gravity as given..... 15.00 "

Resulting value of metacentric height..... 3.33 "

PART (2) DISCHARGE PORTS OPEN

In this case the water in the hopper will rise till it stands at the same level as that outside.

Let X = depth of water above bottom in hopper
Y = increase in draft of barge due to opening of hopper to sea
Then $50 \times 40 \times X = 200 \times 40 \times Y$
also $X = Y + 10$
whence $Y = 3.33$ and X = new draft = 13.33 feet.

There are now two methods of solution possible. (a) The "Lost Buoyancy." (b) The "Added Weight." For a detailed discussion of the principles involved, see any standard work on theoretical naval architecture. The results when expressed as the moment of statical stability are the same for each method though the metacentric height differs in inverse proportion to the displacement resulting.

LOST BUOYANCY

$$M = 6.667 + \frac{(40)^3 \times 200 - (40)^3 \times 50}{12 \times 150 \times 40 \times 13.33} = 16.667 \text{ feet.}$$

This method assumes that the original buoyancy of the hopper space is lost without other effect on the ship; hence the position of the center of gravity is unchanged and the metacentric height is 1.667 feet. Moment of statical stability = *2285 x 1.667 = 3809 foot tons.

ADDED WEIGHT

$$M = 6.667 + \frac{(40)^3 \times 200}{12 \times 200 \times 40 \times 13.33} = 16.667$$

Virtual center of gravity of added water =

$$6.667 + \frac{(40)^3 \times 50}{12 \times 50 \times 40 \times 13.33} = 16.667$$

Barge empty $2285 \times 15 = 34275$
Water admitted $761.7 \times 16.667 = 12695$

3046.2 15.417 46970

Value of G. M. = 16.667 — 15.417 = 1.250
Statical moment of stability = 3046.2 x 1.25 = 3809.

PART (3) HOPPER FILLED TO HEIGHT OF 10 FEET WITH MUD

Weight added to displacement as in part 1 =

$$\frac{50 \times 40 \times 10}{17.5} = 1142 \text{ tons}$$

New displacement = 2285 + 1142 = 3427 tons.

$$\text{New draft} = \frac{3427}{19 \times 12} = 15.04 \text{ feet.}$$

Mud of the density specified probably will not be a solid mass nor will it flow as easily as water. Hence its effect upon the stability of the barge will not be exactly that as calculated upon either the assumption of solidity or of full free surface but will be somewhere between the two.

Figured as a solid we have

$2285 \times 15 = 34250$
$1142 \times 10 = 11420$

3427 13.33 45670

$$M = 7.52 + \frac{(40)^3 \times 200}{12 \times 40 \times 200 \times 15.04} = 16.39$$

Value of G. M. = 16.39 — 13.33 = 3.06 feet.

*Weight of barge.

Figured as a liquid with full free surface we have M for mud in hopper =

$$5 + \frac{(40)^3 \times 50}{12 \times 40 \times 50 \times 10} = 18.33$$

Then by added weight method

$2285 \times 15 = 34275$
$1142 \times 18.33 = 20940$

3427 16.1 55215

Value of G. M. = 16.39 — 16.1 = .29 feet.

When the barge is subjected to the action of waves, the motion of the mud might be sufficiently sluggish so that its effect on the motion of the barge would be less serious than a more easily flowing liquid.

If, on the other hand, the barge were in quiet water and were given a slight initial list, the mud would eventually take practically as great a transverse shift as a lighter liquid.

Motorship Kennecott

(*Concluded from page* 780.)

RECORD RUN TO NEW YORK

On her second voyage from Seattle, Wash., to New York she loaded 3,000,000 feet of lumber and 1,200 tons of copper ingots on Puget Sound, and then proceeded to Aberdeen, Grays Harbor, where another consignment of lumber was taken aboard. She left Aberdeen on May 6 and arrived at Panama on May 20, a distance of 3,960 miles, and arrived at New York on May 29, a total distance of 5,994 nautical miles in 23 days and 7 hours. On this run the engines were operated at from 126 to 130 revolutions per minute. Unfortunately, however, an absolutely accurate account of oil consumption was not kept, but as nearly as possible in checking the contents of the fuel tanks the daily consumption is calculated as 60 barrels, or 8½ tons.

During the time of loading in Seattle a careful check of oil consumption of the auxiliaries was kept and it was found that it took only 31 barrels of oil to load the 3,000,000 feet of lumber. Further perusal of the log discloses the fact that with all four cargo hatches and all eight winches working, the fuel consumption, including the electric light, standby pumps and all other equipment, amounts to only four barrels per 24 hours, a charge which, it is claimed, cannot be equalled by the most efficient steamship in operation.

Upon the vessel's return voyage from New York to Seattle a general cargo was loaded of approximately 3,500 tons and during the entire trip an average of 10.9 knots was maintained on a daily consumption of 60.5 barrels of low grade fuel and average port consumption of 2.3 barrels. It is interesting to note that the average engine room temperature for the round voyage was 85 degrees, the variation above and below this temperature being never more than a few degrees Fahrenheit.

The engines were operated at an average of 129 revolutions per minute from New York to Colon, and 131 from Balboa to Seattle.

RELIABILITY PROVED

Nothing further need be said as to the reliability of her machinery, as in the actual words of the owners they are "more reliable than steam," having been in constant operation for six months and covering approximately 15,000 miles without one cent being expended for repairs.

Considerable credit is due the Todd Dry Dock and Construction Corporation in the design and construction of the *Kennecott*, as never before has this concern built or had any actual experience in the construction of full Diesel motorships. To turn out, without previous experiment, so successful and consistent a vessel speaks well of the engineering ability to be found in our western shipyards.

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PERSONAL MENTION

Thomas H. Rossbottom, vice-president and general manager of the Panama Railroad and Panama Steamship Company, has been appointed general manager of the United States Lines, 45 Broadway, New York. He has taken up active duty in his new quarters and will continue to devote a few hours each day to the business of the Panama Company. Mr. Rossbottom was born in New York City in 1874 and received his early training in the public schools, business colleges and evening commercial schools. He first went with the Panama Railroad Company in 1887 and is widely known in railroad and steamship circles as an expert traffic manager, having been advanced by various stages through the departments of traffic, cashier, operating, both land and marine. When the Columbian Steamship Line was taken over in 1893 by the Panama Company, Mr. Rossbottom became active in ship operation, being advanced until he had become third vice-president in charge of operation of the Panama Railroad and Steamship Line. It is believed his appointment to managing affairs of the United States Lines is temporary in order that the clearing up of the transportation situation may have the benefit of his expert knowledge and training.

T. H. Rossbottom

David W. Niven has been appointed manager of the marine sales of the General Electric Company. In his new position Mr. Niven will direct sales to the Federal Government for naval and other purposes. Mr. Niven has been with the General Electric Company for twenty-one years and in the marine department since 1910. He is a native of Scotland and before coming to this country was identified with the Siemens Brothers in London.

D. W. Niven

M. F. Cropley, formerly assistant manager of the Admiral Line, has been appointed manager of this line for the Oregon district. Mr. Cropley is one of the best known steamship men on the Pacific Coast. Starting years ago as cashier on the docks of the Alaska Navigation Company, he was soon promoted to the office of general agent. When the Alaska Navigation Company and the Pacific Coast Steamship Company were consolidated as the Admiral Line, Mr. Cropley was appointed general freight agent, later he was promoted to the position of passenger and traffic manager at Los Angeles and subsequently held the same position in Portland, Ore. In April, 1920, he was made assistant manager of the line.

George W. Barr, son of John W. Barr, a director of Vickers, Ltd., Barrow-in-Furness, England, has been appointed general manager of the shipbuilding department of Vickers, Ltd., vice Robert Pollock resigned. Mr. Barr left Barrow ten years ago to become shipyard manager of the Australian Dockyard, Sidney, Australia, and subsequently became outside manager for Beardmore, Ltd., Dalmuir, Scotland.

E. S. Gregg, of the American International Corporation, New York, has been appointed by Secretary of Commerce Hoover to head the new transportation division of the Bureau of Foreign and Domestic Commerce. During the war Mr. Gregg was a member of the shipping section of the general staff of the War Department. Since leaving the War Department he has been adviser on shipping to the American International Corporation.

David B. Carson, of Nashville, Tenn., for many years general manager of the Nashville, Chattanooga and St. Louis railroad, has been appointed Chief of the Bureau of Navigation, Department of Commerce, to succeed Eugene T. Chamberlain, who has been in charge of this Bureau for more than twenty-seven years. Mr. Carson assumed his duties as Acting Commissioner of Navigation on August 27, pending confirmation of his appointment by the Senate. Mr. Carson is not only an experienced railway man but has also had extensive experience in matters pertaining to marine transportation, through supervision of river and transfer steamers for the Nashville, Chattanooga and St. Louis railroad. Mr. Chamberlain, the former Commissioner of Navigation, who has been made assistant to the chief of the transportation division of the Bureau of Foreign and Domestic Commerce, was appointed Commissioner of Navigation by President Cleveland in 1893 and served through the Republican and Democratic administrations of Cleveland, McKinley, Roosevelt, Taft and Wilson.

David B. Carson

Thomas A. Graham, formerly assistant freight traffic manager of the Southern Pacific Company, has been appointed general manager of the Pacific Mail Steamship Company, vice John H. Rosseter resigned. Born in San Francisco in 1864, Mr. Graham was not quite fourteen years old when he took his first job as an office boy for the North Pacific Coast Railroad, a line operating between San Quentin and Duncan's Mills, Cal., which is now a part of the Northwestern Pacific system. Transferring to the Southern Pacific Company in December, 1881, Mr. Graham was at first a clerk and then chief rate clerk in the San Francisco general passenger office until December, 1889, when he became district passenger and freight agent at Tacoma and Seattle. After ten years he was made district freight and passenger agent at San Jose, Cal., serving in that capacity until 1901 when he became assistant general freight agent at San Francisco. Four years later he went to Los Angeles as assistant general freight and passenger agent, coming back to San Francisco in 1911 as general freight agent. A year later he was made assistant freight traffic manager, retaining this position until his present change to the Pacific Mail Steamship Company.

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J. P. SUTHERLAND has been appointed head of the passenger branch of the traffic department of the United States Shipping Board.

SAMUEL MAGRILL has been appointed general freight agent of the Black Diamond Steamship Corporation, vice Paul D. Kaufmann, resigned.

CAPT. E. L. MCNOBLE has been appointed superintendent of terminals for the Admiral Line at Seattle. He has been acting as port captain.

W. E. DECKER has been appointed purchasing agent of the Port Arthur Shipbuilding Company, Port Arthur, Ontario, succeeding N. S. Thrasher, who died recently.

WILMER M. WOOD, formerly on the staff of the Kerr Steamship Company, has been appointed general freight agent of the United American Lines' intercoastal service.

GEORGE W. STERLING, formerly director of operations of the Shipping Board for the New York district, is now associated with the Export Steamship Corporation, New York.

H. A. DUFFY, formerly chartering executive of the Shipping Board, is now connected with the Equity Steamship Company, 11 Broadway, New York, covering the general chartering market.

MORRIS MALKIN, of New York, who during the war was secretary of the Chartering Committee of the Shipping Board at New York, has been appointed manager of the Shipping Board chartering department in New York.

JOSEPH A. ROBINSON, of Armstrong, Loeser & Robinson, steamship agents and ship brokers, of New York, has been appointed an assistant on the staff of J. Barstow Smull, vice-president in the operating division of the United States Shipping Board.

R. L. FRANCIS, formerly freight traffic manager in charge of the eastbound section of the United American Lines' service between the east and west coasts of the United States, has been appointed manager of the Philadelphia office of this company.

JOHN A. BAILEY, formerly with the Baltimore Dry Docks and Shipbuilding Company, Baltimore, Md., has been appointed assistant manager of the department of maintenance and repairs, United States Shipping Board, New York, succeeding Commander V. V. Woodward, who has returned to the Navy Department.

DENNIS A. MALONEY has been appointed special representative of the United States Shipping Board at Buenos Aires, Argentina. Captain Maloney has served as an American shipmaster for a number of years and has also had a wide experience in ship repair work, stevedoring and other branches of the shipping industry.

OBITUARY

GEORGE SIMPSON, naval architect, New York, died suddenly on August 22 from heart disease, aged fifty-seven years. Mr. Simpson was born in Colon, Scotland, and received his education in the Colon University and the Architectural Institute of Colon. For several years he was designing draftsman at the works of the Fairfield Shipbuilding Company. Later he was naval architect and works manager of J. S. White & Company, Cowes, Isle of Wight. Coming to this country he was placed in charge of the drafting room of the New York Shipbuilding Company, Camden, N. J., soon after the opening of the plant. Three years later he became chief draftsman at the Fore River Shipbuilding Company, Quincy, Mass. For the past nine years he maintained an office as a naval architect in New York. Several features of ship construction were introduced by Mr. Simpson, including an improved topside tank construction, modified transverse framing and the "bilge tunnel." Mr. Simpson was an occasional contributor to the literature of shipbuilding and naval architecture and was the author of "The Naval Constructor."

FRANK F. BOULTON, president of the Federal Steamship Line, died recently at his home in Brooklyn, N. Y. Mr. Boulton was born on Staten Island fifty-one years ago and throughout his business career has been engaged in the shipping business. He was president of the Maritime Association of the Port of New York; vice president and chairman of the board of the National Dry Dock Company; president of the F. F. Boulton Company and a director of the American Merchant Marine Insurance Company.

NEW BOOKS

THE PORT OF NEW YORK ANNUAL, SECOND EDITION. Published by Smith's Port Publishing Company, New York. Cloth, 528 pages; size, 8x11 inches. Illustrated and indexed.

The main features of this second Port of New York Annual consist of: 1. A series of studies from data accumulated by the U. S. Shipping Board, but never compiled by it, the tabulation in this case being made for the Port of New York Annual, exclusively, by an expert. These studies cover a retrospective review of the foreign commerce, the handling of grain, coal and fuel oil at American seaports, how ships spend their time in port and the cost of loading and unloading at different seaports. 2. An illustrated description of the twin vehicular tunnels under the Hudson, contributed by T. Albeus Adams, chairman of the New Jersey Vehicular Tunnel Commission. 3. A mass of up-to-date information regarding the new "Port Authority," which is about to come into control and administration of the entire Port of New York, under the auspices of the States of New York and New Jersey.

ELEMENTS OF MAP PROJECTION WITH APPLICATIONS TO MAP AND CHART CONSTRUCTION. By Charles H. Deetz, cartographer, and Oscar S. Adams, geodetic computer. Special Publication No. 68, U. S. Coast and Geodetic Survey. Pages, 163, frontispiece. Size 7½ by 11¼ inches. Figures, 74; 8 folded plates. Washington, D. C., 1921: Government Printing Office.

The whole field of cartography, with its component parts of history and surveys, map projection, compilation, nomenclature and reproduction, is so important to the advancement of scientific geography that the selection of suitable map projections is receiving far more attention than was formerly accorded to it. The exigencies of the problem at hand can generally be met by special study, and, as a rule, that system of projection can be adopted which is ideal or most useful for the area under consideration.

This volume is a comprehensive treatise on all the more useful projections, presenting them in as simple a form as possible in their general characteristics, mathematical development and actual construction.

Part I of the book covers the subject in general without the employment of any mathematical formulas and serves as a stepping stone to Part II, an arrangement which, it is believed, will best meet the needs of the student and the chart-producing agencies. In the selection of projections for present-day use in Part II, the authors have limited themselves, with two exceptions, to two classes, viz., projections that are *conformal* and projections that are *equal-area* or *equivalent*. The exceptions are the polyconic and gnomonic projections—the former covering a field entirely its own in its general employment for field sheets in any part of the world and in maps of narrow longitudinal extent, the latter in its application and use to navigation.

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Shipping and Ship Operation News

Changes in Steamship Routes — Passenger and Freight Activities—Launchings and Other Notes of General Interest

Trade Improvement Continues As American Shipping on Pacific Coast Holds Previous Betterment

New Services and New Carriers Added to Handle Intercoastal and Foreign Trade—Increased Business for Various Products—Thirty Ships to Handle 5,000,000-Bushel Wheat Contract

Further indication of the steady revival of American shipping on the west coast is seen in reports from Seattle, Wash., of the addition of two new services and several new carriers to handle trade in Puget Sound's intercoastal and foreign trade. The *Mongolian Prince*, due to sail from Seattle to the United Kingdom and continental Europe about the middle of September, inaugurates the new service of Furness-Withy & Co. and will carry northwest flour, wheat, canned goods, lumber and general merchandise to London and Antwerp. Entrance of the Compagnie Generale Transatlantique into the trade between Puget Sound and European ports has been announced by the Transocean Company, agents for the French Line on the Pacific Coast. Regular monthly sailings are to be maintained beginning in November. Increasing the fleet of the European Pacific Line of the Shipping Board to twelve carriers, the Chinese built freighter *Celestial* has been assigned to service between Seattle on the Pacific Coast and ports of Europe. The *Celestial* loaded flour, lumber and other freight for London, Liverpool, Glasgow, Hamburg and Antwerp. The barkentine *Catherine MacKall*, of the W. L. Comyn & Co. fleet, is to take northwest products to South Africa. This is the first time in ten years a sailing vessel has been on berth on the west coast to carry general cargo to this destination.

Greatly increased bookings on apples for northwest states through Seattle have been the result from the lowering of steamship freight rates on apples to $1.00 a hundred pounds from Puget Sound to Atlantic ports and to $1.00 a box to Europe. According to reports, shippers can export apples through Seattle to Europe and save 37 cents a box over the route from Yakima and Wenatchee valleys to Atlantic ports by rail and thence across the Atlantic. Yakima County, 120 miles from Seattle, expects to ship 13,000 carloads of apples this year. The short haul from Yakima to Seattle costs 16 cents and with $1.00 for freight and refrigerator space to Europe makes a total of $1.16 a box. Shipment from Yakima under ice from the Atlantic Coast costs 88 cents a box, according to statements of growers; refrigerator space across the Atlantic is 65 cents, making a total of $1.53 a box and giving Seattle's water route a 37 cents differential

Seattle's import and export trade with Atlantic Coast ports by the all-water Panama Canal route totaled $10,051,458 the first seven months of 1921, compared with $4,695,472 for the same period of 1920. The Seattle import products valued $4,731,110 from the Atlantic Coast on the all-water route, while figures for the first seven months of 1920 were $639,557. During the first seven months in this year Seattle exported northwest products valued at $5,320,348 to Atlantic Coast ports as compared with $4,055,925 during the same period in 1920. Imports accordingly increased more than $4,000,000, while exports showed a gain of more than $1,000,000.

The steamship *West Botus* recently discharged 10,000 bags of green coffee at Seattle, emphasizing the increasing coffee trade resumed between Puget Sound and the east coast of South America. The vessel is in the Pacific, Argentine and Brazil service of Swayne & Hoyt.

Announcement is made of the signing of contract between the port of Seattle and J. A. Pease, representing Eastern capital, whereby 5,000,000 bushels of wheat, enough to fill 30 ocean steamships, will be moved annually through Seattle, making Puget Sound a great wheat exporting center. It is believed that most of this year's 5,000,000 bushels will move out of Seattle, Wash., before Christmas and the first shipments are now being moved. Other interesting figures on the improvement of shipping on the west coast show that a solid train load of 28 cars of milk, condensed by the Carnation Milk Products Company of Seattle, was recently shipped from Puget Sound to New York to be transported to England; Seattle's import and export trade with Germany during the first seven months of 1921 amount to nearly $700,000 as compared with none for the same period of 1920.

Reduction in Passenger Rates

Announcement has been made by the United States Lines of a reduction of $25 in third-class passenger rates to apply to all steamers of the company.

MOTOR BOAT SHOW

To Be Held in Grand Central Palace February 17 to 25, 1922

At a meeting of the show committee of the National Association of Engine and Boat Manufacturers, held Monday, August 29, at the offices of the organization, 29 West 39th Street, New York, it was decided to hold the 17th National Motor Boat, Ship and Engine Exposition in Grand Central Palace, February 17 to 25, 1922. This is the second big exposition committee to announce a Palace Show for 1922, the National Automobile Chamber of Commerce securing space last month, for its annual display of passenger cars and accessories in January. The motor boat display will occupy two floors in the Palace building and the industry in all its ramifications will be exhibited.

Immediately after the decision of the show committee, Ira Hand, who has managed the big motor boat shows held in New York City, left for Detroit. Undoubtedly the manufacturers and builders will welcome Hand with enthusiasm, for up until a month ago it was doubtful if there would be another motor boat show held in New York City because of lack of suitable building accommodations. It was announced last year that no more exhibitions would be held in the Palace, as the building was to be made into an office building. The exhibition committee in charge of the details of the exposition is composed of the following motor boat men: John J. Amory, chairman; James Craig, Charles Criqui and Henry R. Sutphen, the last named being president of the National Association of Engine and Boat Builders.

Maritime Capacity of Marseilles Is to Be Doubled

Marseilles, which is already the most important port and the second largest city in France, is to have its present maritime capacity doubled, according to advices just received by the Bankers Trust Company of New York, from its French Information Service.

The Societe Marseillaise de Credit reports that constructional work on the project is already under way. The task of doubling the port's capacity is indicated by the size of the present port. With its 10 basins it covers about 780 acres and comprises about 15 miles of wharf and 36 miles of railroad. The very complete dock equipment numbers, among other things, one 120-ton crane.

The amount of navigation, which had fallen off to a considerable extent, is rapidly regaining its pre-war volume. In 1913, 17,278 ships.

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Steamship Interests

It is announced that Williams, Dimond & Company have acquired the 11,000-ton Shipping Board steamer *West Greylock*, built at Los Angeles. The company will place the vessel in the Oriental service for a trip or two and then will operate her to Europe and coast points.

A monthly freight service was established by the Compagnie Generale Transatlantique between Bordeaux and San Francisco with the sailing on September 5 of the steamship *Ontario* from Bordeaux, for Cristobal, Corinto, La Libertad, Mazatlin and San Francisco.

The United States Navigation Company, New York, has announced three Smith Line Boats, the *Winifried, Bradford City* and *Union City*, for freight service between New York and Hamburg. These vessels will sail at intervals of two weeks beginning on September 24.

A successful trial of the Peabody burner system in the electric drive ship *Independence* has been completed by the Shipping Board Trial Board, H. B. Taylor being the chief engineer in charge. On the first trials of the *Independence* difficulty was encountered in maintaining the desired steam pressure and it was stated that the trouble was due to water in the fuel oil, which has now been rectified.

The passenger liner *Bayern* of the Hamburg-American Line was scheduled to sail from Hamburg for New York on September 15, thus being the first passenger steamer flying the German flag to arrive at New York since August, 1914. According to an arrangement made between the United American Lines and the Hamburg-American Lines two more German vessels and three American steamers will compose the fleet plying in this service.

Construction of the new passenger liner *Statendam* of 32,000 tons, has begun at the yards of Harland & Wolff, Belfast, as part of the extensive program of the Holland America Line for enlarging its fleet. It is expected the vessel will be launched in 1923. Harland & Wolff are also building for the same company two 18,000-ton ships and the engines for twelve smaller vessels one of which has been completed.

The Agwi Steamship Lines report net earnings for the first six months of $1,349,037. This profit was obtained principally from operation of the company's tanker fleet, combined with earnings of the Clyde, Mallory, Ward, New York & Porto Rico and Southern lines, and was entirely independent of the operations of the Atlantic-Gulf Oil Corporation. The showing was aided by favorable charter rates prevailing early in the year on the tankers.

A new general cargo service was started the latter part of August by the New York Sydney Steamship Lines. The first steamer sailed from New York for Sydney on August 25 and there will be regular sailings in the future. Officials of the company state that important business interests in New York and Sydney have promised their support to the new venture and that they believe the volume of business between the two countries will show a steady increase.

It is reported that the Furness, Withy Company has established a new monthly freight service between the Pacific Coast ports of North America and Europe, to be known as the Furness, Prince Line. The *Mongolian Princess*, the first ship to ply in this service, is already under way with a Pacific Coast port as its destination. This new service will specialize in the carrying of meats, citrus fruits and other perishable cargoes, and one ship with refrigeration facilities has already been provided.

The Barr Shipping Corporation, 25 Beaver Street, New York, has announced the following freight rates for the coming season on shipments from New York to ports of the United Kingdom, to take effect beginning August 25:

Barrels of apples and pears, ordinary stowage, $1.25; refrigerator stowage, $1.75; boxes, ordinary stowage, 45 cents; boxes, refrigerator stowage, 65 cents; half boxes of pears and plums, refrigerator stowage, 40 cents.

It is reported from Seattle that the Compagnie Generale Trans-Atlantique will inaugurate a monthly fast freight service between North Pacific and French Atlantic ports next November. Eight steamships, the names of which have not as yet been announced, will be placed in this service, but it is understood that the vessels will be of 12,000 tons cargo capacity and have a speed of 13 knots. It is probable that, if business warrants, passenger service will be put on the route.

The Gulf & Intercoastal Steamship Company, Houston, Tex., plans to inaugurate a passenger and freight service between Houston and Corpus Christie starting on September 15, on which date an initial schedule of five trips a month will be announced. The main office of the firm will be in Houston, but the Corpus Christie terminal will be equipped with wharves, warehouses and such other permanent equipment as the business appears to justify. A steam vessel having cabin accommodations for sixty passengers and a cargo carrying capacity of 150 tons will be placed on this route.

Jos. A. Nash, North American Manager for the Lloyd Royal Belge, Belgium's largest steamship company, recently made the statement that he finds trade with the United States improving. Mr Nash states: "The increase in cargoes is small and slow, but there is an increase. This sort of growth is better than sudden inflation. I have reports from various parts of the country that great exporting industries are preparing for brisk winter business. To say that conditions have not yet reached the bottom of depression is unjustified. They have begun to rise from their lowest point and are climbing upward in a firm movement."

It is announced that the firm of Sea Carriers, Inc., will inaugurate a new regular steamer service between points on the Atlantic seaboard and Pacific ports with the sailing from New York on October 1 of the American steamer *A. L. Kent*. Five vessels will be put on this route, including the steamers *Felix Tausig, William A. McKenney* and *Thomas P. Beal*. It is expected that the vessels will stop at all the usual Pacific ports from Los Angeles to Seattle, and possibly the Canadian ports. Houlder, Weir & Boyd, 42 State Street, New York, will be general Atlantic Coast agents for the company.

Marking the active entry of another Japanese steamship line into the competition for export and import trade through Seattle, Wash., the Yamashita Kisen Kaisha Steamship Company's frighter *Yoshida Maru* No. 1, berthed at Seattle September 2, is scheduled to be followed by two other ships of the same company.

August 31, 1921, marks the 25th anniversary of the Nippon Yusen Kaisha Steamship Company service between the Orient and Seattle, its American terminus. During the twenty-five years 608 "N. Y. K." steamships have touched at Seattle, bringing in more than $2,500,000 of imports and carrying out over $3,000,000 of exports.

The Clyde-Mallory Lines announce the inauguration of a new service between Baltimore and New York with the sailings from New York on October 12 of a steamer for Baltimore, and on October 15 from Baltimore for New York. The steamships *Norfolk* and *Philadelphia*, each of 2,500 tons, have been chosen for this service and will continue regular weekly sailings on Wednesday and Saturday of each week. Increased business between New York, Charleston and Jacksonville has caused the Clyde-Mallory Lines to add two more vessels to this route, thus making possible four sailings weekly, instead of three as heretofore.

Porto Rico Line Announces Reductions in General Cargo Rates

The Porto Rico Line, 25 Broadway, New York, announces a general reduction in south bound and north bound general cargo rates between New York and Forto Rico and between New Orleans and Porto Rico. The average reduction is slightly in excess of 10 percent, although on some commodities the reduction has been greater, the latter list including fertilizer, from $9 to $7 per ton; cement, from $1.25 to $1 per barrel and tobacco, from 20 cents to 16 cents per cubic foot.

It is stated that these reductions give the island of Porto Rico the benefit of a freight tariff which averages 40 percent lower than the freight rates applying between North Atlantic ports and other similar ports in the West Indies. A list of the reductions on some of the more important commodities is as follows:

	From	To
Packing house products	63c per 100 lbs.	60c per 100 lbs.
Fertilizer	45c per 100 lbs.	35c per 100 lbs.
Cement (per bbl. 400 lbs.)	$1.25 each.	$1 each.
Fish dried, pickled.	63c per 100 lbs.	60c per 100 lbs.
Foodstuffs	50c per 100 lbs.	45c per 100 lbs.
Machinery	31c per cu. ft. or 75c per 100 lbs.	28c per cu. ft. or 69c per 100 lbs.
Lumber, per M. F.		
White pine, rough	$16.25 M.	$14.50 M.
Dressed yellow pine.	$20 M.	$18 M.
Oak hardwood	$22.50 M.	$19 M.
Oil, kerosene (per bbl.)	$2 each.	$1.85 each.
Ten gallon case.	44c each	40c each
Automobiles, pleasure.	31c cu. ft.	28c. cu ft.
Furniture	28c cu. ft.	25c cu. ft.
Dry goods	31c per cu. ft. or 75c per 100 lbs.	28c per cu. ft. or 69c per 100 lbs.
Silks	38c per cu. ft.	35c per cu. ft.
Vegetables	63c per 100 lbs.	60c per 100 lbs.

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I. M. M. to Occupy New Quarters at No. 1 Broadway

Announcement is made by the International Mercantile Marine Company that it expects to occupy its new quarters at No. 1 Broadway, New York City, in November, which serves to call attention to the renaissance of one of the most interesting business structures in New York.

New Offices of I. M. M.

The booking office is designed to represent the latest ideas in practical utility, with extensive counter space, a waiting room for customers, a department devoted to the issuing of travelers' checks, and a section for the distribution of travel literature.

One strikingly modern feature of the booking office will be a small motion picture theatre, for the projection of films portraying life on the company's ships when on the Atlantic passage or tropical cruises.

Four floors above the booking office will be occupied by executive offices of the company and its constitutent lines, including a floor devoted to the accounting department, another to freight, another to operating, and the fifth to the general offices of the company and their clerical staffs, and the board room.

On the Greenwich street level will be the third class department, with extensive counter space offices, waiting rooms, etc.

Operating Losses Cut to $5,000,000 a Month, Chairman Lasker Says

It is announced by Chairman Lasker that the Shipping Board has cut its operating losses to the point where they will not run above $5,000,000 a month, and that the end of the drain on the public treasury is now in sight. Enforcement of the Jones Act together with a moderate revival of trade, he stated would wipe out the operating deficit within the next two years.

The Board has made its plans to keep expenditures within the $100,000,000 budget for the current year and has asked for an appropriation of only $50,000,000 for the fiscal year beginning next July. It is the belief of Chairman Lasker that not more than $75,000,000 will be required for operations this year, and that the additional $25,000,000 will be used to complete construction, but should it be decided to recondition the *Leviathan*, it would make necessary an additional appropriation of $8,000,000 to $10,000,000. In explaining the budget of $100,000,000 for the current fiscal year, Mr. Lasker says that Congress has already appropriated $48,500,000 for operations and $25,000,000 for construction, leaving $26,500,000 which will be requested from Congress later as the need arises. He states that these two appropriations should tide the board over, providing that private owners can operate profitably under the indirect benefits that would accrue under the Jones law. No amount has been provided for the settlement of claims or the payment of the past debts which the board has assumed, but it is expected that past debts can be discharged through the collection of $20,000,000 now due the board.

MILLION DOLLAR JOB

St. Louis to Be Reconditioned for "I'll Tell the World" Trip

Specifications have been issued for one of the biggest repair contracts of the year—the reconditioning of the steamship *St. Louis* for the Anderson Overseas Corporation, 165 Broadway, New York City, at a cost estimated at close to one million dollars. For several weeks the ship has been at the yard of the James Shewan & Sons' Inc., Brooklyn, N. Y., pending the award of the contract. Among other improvements, it is expected the steamer will be converted from coal to oil burning.

The *St. Louis* is a twin screw ship, has five decks and is propelled by quadruple expansion engines. She is 535 feet in length, with a beam of 63 feet and displaces 11,600 tons.

The completion of the reconditioning work is scheduled for December and the ship is to leave New York in January, 1922, for a "round the world trade cruise," bearing exhibits and representatives from American manufacturers and businessmen, and visiting all the principal countries of the world. The entire main deck and portions of the promenade deck have been set aside for exhibits and the open forward deck is reserved for heavy machinery. It is stated that the exhibition space amounts to approximately 30,000 square feet—equivalent to "taking Madison Square Garden around the world." The Anderson corporation is carrying forward extensive plans for the trip, which is to last a year and will be in the furtherance of American foreign trade.

The *St. Louis*, which will be painted white, will carry the slogan "I'll tell the world," and will have the following tentative itinerary:

Havana, Kingston, Pernambuco, Bahia, Rio de Janeiro, Santos, Montevideo, Buenos Aires, Cape Town, Port Elizabeth, Durban, Delagoa Bay, Mauritius, Perth, Adelaide, Melbourne, Sydney, Wellington, Yokohama, Tientsin, Shanghai, Hong Kong, Manila, Sagon, Surabaya, Samarang, Batavia, Singapore, Penang, Rangoon, Calcutta, Madras, Colombo, Bombay, Crachi, Aden, Port Said, Constantinople, Salonica, Genoa, Marseilles, Barcelona, Gibraltar, Cadiz, Lisbon, Boulogne, Southampton, Antwerp, Rotterdam, Hamburg, Gothenburg, Christiania, Bergen, New York.

New West Coast Freighter to Engage in Pacific-European Trade

Another 11,000-ton flush deck freighter, the *West Greylock*, built, engined and equipped at the plant of the Los Angeles Shipbuilding & Dry Dock Company, has been given her sea trials under the supervision of officials of the United States Shipping Board and of the building company.

The several tests to which a new vessel is subjected before being taken over from the builders by her owners occupy a full day at sea. There are speed trials, reverse speed trials, rudder tests, anchor tests, etc. In all of these the *West Greylock* passed to the full satisfaction of all concerned. In her speed trials without cargo, and therefore with her propeller half out of water, the freighter made an average of 11.87 knots for the six-hour test over the measured run. In this she did a shade better than her sister ships, the *West Faralon* and *West Lewark*, which have been sent out from the same plant during the last few weeks and which have already attracted much favorable comment from shipping men along the Pacific Coast.

The *West Greylock* is understood to have been chartered by Williams, Dimond & Company, the charterers of both the *West Lewark* and *West Faralon*. The two latter ships have been immediately placed in the Pacific-European trade. It is said that the *West Greylock* will be used by these international shippers for the long trip first to Oriental ports and then to Europe.

The particular point of interest to the shipping men apart from the good speed and economy in fuel shown by this type of freighter is said to lie in their provision and admirable arrangement of hatchways and cargo handling appliances. The design for the vessel was worked out at the plant of the builders following suggestions made by practical shipping men who had found that the docks of most ports were seldom provided with sufficient cargo handling machinery, consequently causing considerable delay and loss of time in unloading the cargo of a freighter. It was particularly to obviate this trouble that deck derricks were provided in quantity and capacity sufficient to assure rapid discharging of cargo, thus making the ship practically independent of the cargo-handling equipment of the ports at which she might call. While in San Francisco, recently, the *West Lewark*, the first of the five of this class of vessel now being built by the Los Angeles concern, found it possible to employ at the same time nine separate gangs of stevedores.

Keel Laid for Jap Tanker

In the presence of a number of Japanese and American officials the keel of the fuel supply ship *Kamoi*, which is to carry oil and coal for the fleet of the Imperial Japanese Navy, was laid on September 14 at the plant of the New York Shipbuilding Corporation in Camden, N. J. The ship will be of 20,000 deadweight tons, 496 feet in length and will have electric propulsion, the electrical equipment being supplied by the General Electric Company of Schenectady, N. Y.

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Shipbuilding and Shipyard Development

What the Shipyards Are Doing—Dry Dock Notes —Port Expansion Plans—Engineering Projects

Millions to Be Spent for Construction and Equipment of Piers in Big Eastern Ports

Philadelphia and New York Have Vast Projects Under Way—Unusual Contract for American Made Equipment at New York—New Piers Progressing Rapidly

Bids for what is believed to be the biggest equipment contract so far this year amounting to close to $1,000,000 and covering the furnishing, installing and putting into successful operation of cranes, elevators, electric power transmission and steam-heating plants on Piers 12 and 13 at Stapleton, S. I., were scheduled for receipt at the office of Commissioner of Docks, Room 8, Pier A., foot of Battery Place, North River, New York City, at 12 o'clock noon on October 4, 1921.

The contract number is 1686 and the work is divided into four sections. Contract "A" provides for the installation of 34 cranes, the time allowed being 360 calendar days; contract "B" elevators, 180 consecutive calendar days; contract "C" electric power transmission, 120 consecutive calendar days; contract "D" steam-heating plant, 120 consecutive calendar days.

The Board of Estimate and Apportionment of the City of New York adopted on August 2, 1921, a resolution approving the amended plans and specifications for this work with the limitation that the equipment be of American manufacture, the estimated cost of the work being $911,800.

DEVELOPMENTS AT PHILADELPHIA.

At Philadelphia a contract is about to be placed by the Department of Wharves, Docks and Ferries, Bourse Building, for the construction of Pier No. 5, North Wharves, Philadelphia, which will replace old Piers Nos. 3, 4, and 5, North. The firm of Snare & Triest, now the Frederick Snare Corporation, was recently awarded the contract for the construction of the substructure of Municipal Pier No. 3, North Wharves, which contract calls for the tearing out of Piers Nos. 1 and 2 and the partial tearing down of Pier No. 3, North Wharves.

These piers will be combination piers for either the accommodation of transatlantic or coastwise and river traffic; each 185 feet wide by approximately 550 feet long, with all docks or waterways 215 feet wide, except that between the first Pier No. 3 and the ferry house on the south of it, in which the waterway will be 115 feet wide and will make one continuous improvement owned and constructed by the City of Philadelphia, extending from approximately 100 feet north of Market Street to the foot of Cherry Street, where Municipal Pier No. 9 North is located. The piers as well as the ferry house will be connected with a 32-foot wide bulkhead shed, one story high, except for a section at the north end, approximately 112 feet long adjacent to Pier No. 9 North, where a two-story shed will be built for office use. The substructures will be of permanent and massive design and of a type known as the "Fill on Platform" which may be described briefly as:

Timber piling supporting a timber deck covering the entire area of the pier near the low water level which in turn supports a dry fill deposited on the decking and brought up to the level of the main pier deck and retained by concrete walls built on the low level decking along the sides and ends of the pier.

The superstructures will be two-story steel and concrete sheds of modern construction throughout, enclosed on the dock sides with an approved type of turnover cargo doors and terra cotta tile walls, and will be thoroughly equipped with cargo masts, electrically operated elevator winches, chutes, spiral conveyors and other improved cargo handling apparatus. Double car tracks leading from the Philadelphia Belt Line Railroad in Delaware Avenue will extend into the sheds for nearly the entire length of the piers, and will be depressed so that the car floor will be approximately at the same level as the pier main deck. The first deck will be designed for a loading of 600 pounds per square foot, and the second deck for 300 pounds per square foot.

The facades of the piers and bulkhead sheds on Delaware Avenue and the river end elevations will be architecturally treated in brick and terra cotta, and when completed the Delaware Avenue front of the terminal, in conjunction with Cherry Street Pier, to which it connects, will present an unbroken elevation more than 1,000 feet long. This improvement will be known as the Girard Pier Group.

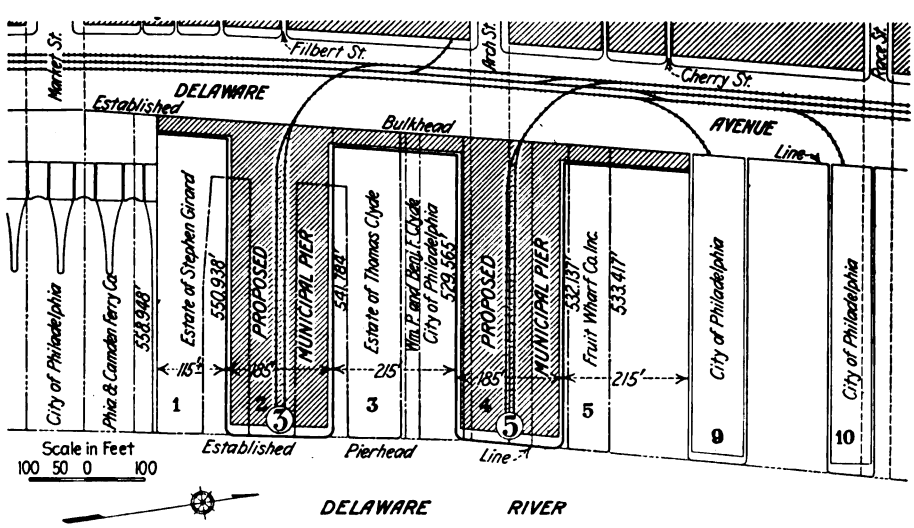
CONTRACT AWARD.

A contract was awarded to the J. S. Rogers Company, Philadelphia, on September 12, 1921, by the Department of Wharves, Docks and Ferries, Philadelphia, for the construction of the superstructure for the Chestnut Street Pier, No. 4, South Delaware Wharves, amounting to $340,000.

The sub-structure for this pier—80 feet wide by 550 feet long—is of permanent construction throughout. The McLean Contracting Company, Baltimore, Md., was awarded the contract for the construction of the sub-structure in the early part of the year.

The superstructure, to be built by the J. S. Rogers Company, is a double-decked steel and concrete building, inclosed on the deck sides by brick-faced terra cotta walls. The lower deck will be equipped for the accommodation of river steamers and the upper deck for offices of the department.

Architectural brick and terra cotta will be used for the inshore and outshore elevations, designed by the City Architect in conjunction with the Engineering force.



Proposed Philadelphia Piers

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New Steel Ferryboat to Be Built for Jamestown and Newport Ferry Company

Plans and specifications have been completed for a steel, double ended screw ferryboat for the Jamestown-Newport Ferry Company, Newport, R. I. The general dimensions of the proposed steamer are: length overall, 150 feet; length between perpendiculars, 123 feet; beam over guards, molded, 48 feet; beam overall, 49 feet; depth, molded, 14 feet; draft, 8 feet. The cost was estimated at close to $200,000.

The steamer will be equipped with a compound engine and Babcock & Wilcox boilers, electrically lighted and steam heated. She will be equipped to meet the requirements of the United States Steamboat Inspection Service. Accommodations will be provided for 500 passengers and 32 average sized automobiles.

Five Million Dollar Expansion Is Planned for the Port of Norfolk, Va.

The Norfolk Port Commission has just advised the City Council that the port development work being planned by the commission will cost in the neighborhood of five million dollars. Barton Myers, chairman of the commission, has recommended that the council consider the question of a bond issue for these improvements for submission to the voters of this city at the November election.

Plans have been drawn, under the direction of the commission, for pier, warehouse and grain elevator facilities, which will cost upwards of four million dollars, and a small boat terminal is also contemplated. The piers, warehouses and elevators will be constructed on property now owned by the city of Norfolk fronting a half-mile on Hampton Roads.

Steamer Pennant to Be Remodeled

The motor tanker *Pennant*, of 3,253 gross registered tons owned by the Pierce Navigation Corporation, 25 Broad Street, New York City, is to be reconditioned, bids for the work being scheduled for receipt on October 3. The ship is to have two Bolinder engines including shafting, thrust, clutch and exhaust piping, also auxiliaries and all their appurtenances removed. The interior of the ship is to be constructed to accommodate steam engines and boilers with necessary auxiliaries, rearrangement of after quarters and construction of new bridge house amidships and will be completed in every detail as a twin screw steamer.

Momus Back in Service

Following the reconditioning of the Southern Pacific (Morgan Line) steamship *Momus*, during which the steamer was converted into an oil burner, regular weekly sailings in each direction between New York and New Orleans were scheduled for resumption on October 1, according to an announcement by L. J. Spence, director of traffic of the Southern Pacific Lines. The sailings will be on Saturdays from New York and on Wednesday from New Orleans.

MUNARGO LAUNCHED

New Ship Takes Dip at Camden, N. J., for Munson Line

The *Munargo*, a freight and passenger steamer, built for the Munson Steamship Line at the Plant of the New York Shipbuilding Corporation, Camden, N. J., was launched Saturday afternoon, September 17, 1921, at 3:10 o'clock.

S. S. Munargo on the Ways

The overall dimensions of the ship are 432'-3" in length, beam 57'-6" and depth 34'-6". It accommodates 172 first class passengers, 56 second class and 50 steerage passengers, together with a crew of 112 men. The cargo carrying capacity for baled cargo is about 299,060 cubic feet, and for grain about 325,000 cubic feet. At load draught the vessel is capable of making 15½ knots per hour. It will be operated between New York and the Central American Ports.

New York City Fireboat

The fireboat *John Purroy Mitchel*, being built by the Standard Shipbuilding Corporation at their yard, Shooters Island, N. Y., is nearing completion and it is expected will go on its trial trip in the near future. The dimensions of this fireboat are as follows:

Length, 132 feet; beam, 27 feet; depth, 14 feet, nine inches.

Henry J. Kimman Dead

Henry J. Kimman, since 1902, manager of the Cleveland plant of the Chicago Pneumatic Tool Company, died in Cleveland, Ohio, September 7. He was born in Harlem, Holland, in 1863 and emigrated to America with his parents and settled in Chicago in 1870.

He designed and in collaboration with his brother built the first practical portable piston air drill, known as the "Little Giant."

73 SHIPS IN AUGUST

Electric Yacht Included in 78,415 Gross Tons Built and Numbered

The Bureau of Navigation, Department of Commerce, Washington, D. C., reports 73 sailing, steam and unrigged vessels of 78,415 gross tons built in the United States and officially numbered during the month of August, 1921. The list includes one electric yacht of 508 gross tons and of the total number four vessels of 34,973 gross tons were built for the United States Shipping Board. The steel ships *Southern Cross* and *John D. Archibold*, the former of 13,741 gross tons, built at Camden, N. J., for the United States Shipping Board, and the latter a tanker of 13,500 gross tons built at Newport News, Va., for the Standard Oil Company, are among the largest vessels included in the list.

The steamships *Emile Deutsch de la Meurthe*, 16,072 gross tons, and the *San Leonardo*, of 5,718 gross tons, are included in the above figures, but were built in this country for foreign owners during the month of August.

Navy Resumes Construction Work on Battle Cruiser

Another bright spot in the shipping situation is seen in the announcement by vice-president G. E. Emmons, in charge of manufacturing of the General Electric Company, Schenectady, N. Y., that the Navy Department has authorized the resumption of work on electrical equipment for one battle cruiser, and hope is expressed that a similar arrangement can be made with respect to a second ship. With regard to the decision of the Navy Department to resume some of its construction work Mr. Emmons said:

"The Navy Department has authorized the resumption of work on electrical equipment for one battle cruiser, with the understanding, however, that shipments will not be required until next summer and no payments for materials and labor are to be made until the next government fiscal year which begins July 1st, 1922.

"This necessitates the company locking up capital for materials and labor until next July, but it gladly does it in order to provide employment to those who would otherwise be out of work during the coming winter.

"When the resumption of work is fully underway, about 500 additional hands will be given employment. It is hoped that a similar arrangement can be made with respect to equipment for another cruiser, which, if successful, will provide work for an additional number of hands."

River Tug Planned

The Mexican Petroleum Company, 120 Broadway, New York, is contemplating the construction of a stern wheel towboat for use in southern waters. The boat, it is understood, will be about 135 feet in length, with a draft of 54 inches, and driven by a single condensing engine. Steam will be supplied by two oil-fired boilers.

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Submarine S-51, Latest of Her Type, Is Launched by Lake Torpedo Boat Company at Bridgeport, Conn.

Newest Undersea Fighter Takes Initial Plunge While Flock of Carrier Pigeons Hover Overhead—Birds Near Messages of Hope That Congress Will Continue Construction Program

The submarine *S-51* was successfully launched recently at the yard of her builders, The Lake Torpedo Boat Company, Bridgeport, Conn. Mrs. R. P. Mills, wife of the manager of the estimating and cost department of that company, acted as sponsor.

This company in launching its submarines usually presents some novelty by which the event can be remembered, and this launching was no exception. The sponsor, immediately after breaking the bottle of champagne over the bow, threw into the air a single carrier pigeon as a signal to the submarine then sliding down the ways, and the men on board dropped the bar releasing the covers of eight massive crates, and just as the *S-51* hit the water for the first time, four hundred and sixty carrier pigeons sailed into the air in a great cloud, circled twice over the heads of the launching party, then straightened out in all directions and were soon lost to view on their flight to various places with the messages attached, to the effect that the "*S-51* was successfully launched that day, the last of her type. Now ready for new construction which it is believed Congress will provide."

CONSTRUCTION

The *S-51* is a double-hulled submarine, regarded by naval constructors as embracing the latest word in submarine construction and development. She is one of ten vessels of the *S-42* to *S-51* group and is the last of four to be built by The Lake Torpedo Boat Company, the other three having been launched and nearly completed.

These vessels were authorized in 1916; however, the order to build was not given to The Lake Company until July 1, 1919.

DESIGN

The design for this class is regarded as a logical development of the *S-3* design and embodies the latest features and improvements known to submarine construction as a result of operations during the World War. To accommodate these new features it was necessary to increase the length of the vessel, thereby increasing the displacement from about 875 to 993 tons. The *S-51* is 240 feet in length overall, with a maximum breadth of hull of 21 feet 6 inches and a draft of about 13 feet 6 inches in normal surface condition. The vessel is of double hull type for one-half the length amidships, the forward and after portion being of the single hull type.

She has been designed to withstand with safety a submergence to 200 feet. The vessel is propelled on the surface by two Diesel engines, each driving a screw propeller. These engines are rated at 950 brake horsepower each. Submerged, the vessel is driven by two electric motors. The armament consists of four 21-inch torpedo tubes in the bow and one 21-inch torpedo tube in the stern. A 4-inch, 50-calibre gun is installed on the deck, forward of the conning tower, and a gun access hatch to enable the gun crew to reach the gun quickly is provided.

Three periscopes are installed, one of which has its eyepiece in the conning tower, but arranged with a platform and trunk to permit the operator to ride up or down with the periscope and take observations at any height. The eyepiece of the other two periscopes are in the control room.

The *S-51* is equipped with radio apparatus, both for surface and submerged work, and with submarine coils for receiving radio messages submerged. Submarine oscillator signaling sets also are provided. Stowage for a 14-foot lifeboat is provided in the superstructure.

American Yards Building 542,117 Gross Tons of Seagoing Steel Ships

There was a total of 70 seagoing steel ships having a total gross tonnage of 542,117 building and contracted for, for the United States Shipping Board and private owners on September 1, 1921, according to statistics compiled by the American Bureau of Shipping. There was a river and harbor steel tonnage building and contracted for in the United States for private owners on September 1, totalling 68 vessels of 39,268 tons. Of the total American ocean ships, 40 were tankers, with a total of 317,204 gross tons, and 17 are cargo boats with a total of 107,951 gross tons. All of the tankers and 12 of the cargo boats are oil burning. These figures are for vessels of private ownership. The total of 8 ships with a gross tonnage of 84,000 building for the Shipping Board are of the passenger and cargo type oil burning, and 3 of 21,900 gross tons are cargo carriers using coal and oil fuel.

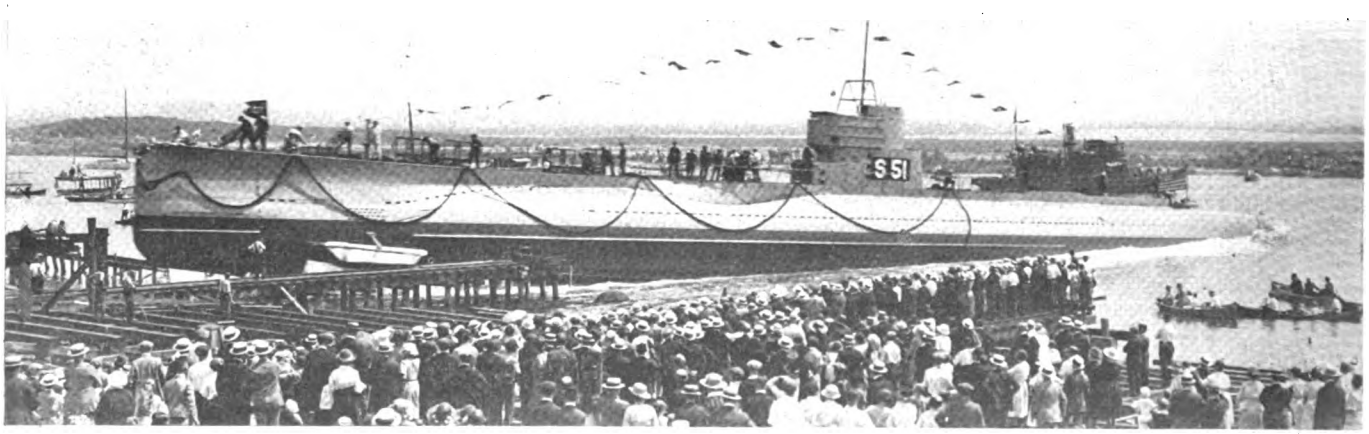
It is also set forth that of the total seagoing steel tonnage building in the United States for the Shipping Board and private owners a total of 48 ships with a gross tonnage of 389,079 are on the Atlantic Coast; 18 ships of 125,438 gross tons are on the Pacific Coast, and 4 ships of 27,600 gross tons are on the Gulf Coast.

In addition to the above figures the Shipping Board is having built in China 2 ships having a total of 14,000 gross tons.

Swedish Cruiser Has Successful Final Trials

Word has been received by the Westinghouse Electric & Manufacturing Company that the final trials of the new Swedish cruiser *Drottning Victoria,* which is propelled by Westinghouse geared turbines, proved highly successful.

The *Drottning Victoria,* and her uncompleted sister ship, *Gustaf V,* are propelled by two 22,000-h. p. turbines of the divided flow type. The gears were built at the East Pittsburgh Works of the Westinghouse Company, and the turbines were built according to Westinghouse design by the Motala Verkstads Nya Aktiebolag of Motala, Sweden.



Launching of the Submarine S-51 at Bridgeport, Conn.

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Marine Construction News of the Month

Ship Contracts — New Ship Concerns and Shipyard Improvements—Terminal Projects—Government Contracts

SHIPS AND SHIPBUILDING

Damage to Lightship No. 41, Boston.—Vineyard Sound lightship No. 41 was damaged to the extent of several hundred dollars recently by being run into by the barge Malvern, which the tug Triton was towing from New York to Boston.

Steamer Bristol Awarded, Brooklyn, N. Y.—The contract for repairs to the United American Line's steamship Bristol has been awarded to the Crane Dry Dock & Repair Company, at a price of $16,900 and fifteen days' time.

Oil Heating System for Three Ships, New York.—The contract for the installation of a fuel oil heating system on the United American Line ships Panaman, Floridian and Ohioian has been awarded the National Dry Dock & Repair Company on a bid of $12,750. The National Dry Dock & Repair Company was also awarded a contract for repairs to the steamer Norfolk, of the same line. It is understood that the work will cost close to $12,000.

Ferry Repair Contract, Brooklyn, N. Y.—James Shewan & Son, Inc., has been awarded a contract for dry docking and overhauling nine municipal ferrybeats of the City of New York. The company was low bidder for the job with a price of $14,935.

To Equip Sub Chaser as Yacht, Vancouver, B. C.—It is reported that A. M. Dollar of the Dollar Steamship Company, having brought the hull of a sub chaser up to Vancouver, B. C., from Bremerton, will soon let a contract to a local shipyard for the conversion and equipping of the hull into a first class yacht.

Inquiry for Barges, Cuba.—A report is current in marine circles that H. Pita, Esq., of Caibarien, Cuba, is considering the placing of an order for two oil barges having a capacity of about 100,000 gallons each, and a wooden schooner.

Pontoons and Barges, St. Helens, Oregon.—It is reported that the St. Helens Shipbuilding Company was awarded a contract to build sixty wood pontoons for the engineer department of the Army. The company also has contracts for several large barges.

To Repair Schooner, Seattle, Wash.—Amundsen's exploring schooner Maud has arrived at Seattle for repairs as well as a complete overhauling and outfitting prior to starting on its next Arctic exploration trip in the spring. This vessel was recently rescued from the Arctic by the United States revenue cutter Bear after having been virtually stripped of her propeller blades.

To Build Barges.—It is reported that Henry Ford is considering the operation of a fleet of self-propelled freight barges between Detroit and the Atlantic seaboard by way of the Erie Canal. Construction of these barges will soon be commenced and they will be so designed as to handle the entire seaboard freight of the Ford Company.

Will Recondition Steamer, Montreal, Can.—It is reported that the passenger steamer Narragansett, owned by the Canada Steamship Lines, Inc., will soon be extensively reconditioned for service on the St. Lawrence river. The vessel is a sister ship of the DeWitt Clinton, recently remodelled for the Hudson River Day Line.

To Build Ferryboats, San Francisco, Cal.—The Union Plant of the Bethlehem Shipbuilding Corporation has been awarded the contract for the construction of three ferryboats for the Six Minute Ferry Company, to cost $1,000,000. These vessels when completed will ply between San Francisco and Oakland.

Steamer Frednes Awarded, Brooklyn, N. Y.—At a price of $15,814 the Ramberg Dry Dock Company has been awarded the steamship Frednes from Porsgrund, Norway. The vessel is to be reconditioned and brought up to Lloyd's Classification, the work being handled by the firm of Macfarlane, Garmey & Company, 32 Broadway, New York.

Shipyard for Sale, New Orleans, La.—It is reported that the plant of the Dollut & Williams Shipbuilding Company is being offered for sale. This yard was established in 1918 for building steel vessels and has four launching ways.

To Enlarge Plant, New Orleans, La.—It is reported that the Jahncke Ship Repair Company is negotiating for the purchase of the river front property occupied by the Jackson Barracks for proposed extensions to its plant.

New Shipbuilding Plant, Brooklyn, N. Y.—The Wheeler Company, care of the Graham Beach Realty Company, is reported as having acquired seventeen lots on Coney Island Creek, Flatbush, on which they propose to establish a new shipbuilding plant, specializing in the construction and repair of small vessels.

Plant Extensions, Algonac, Mich.—Although the Algonac Boat & Machine Company only recently completed an addition to its plant, greater capacity is again required and the company proposes extensions to the plant on the property adjoining it, and which was acquired for that purpose.

Will Recondition Schooner, New York.—The International Petroleum Company of New York has purchased the auxiliary schooner Irages at Tampa, Florida, and will renovate and equip her for special work in Mexico. Whittelsey & Whittelsey, consulting engineers and naval architects, 17 Battery Place, are the engineers in charge.

Launchings, Sparrows Point, Md.—The Nutmeg State, the last of twenty-three passenger liners being built for the Shipping Board, was launched from the ways of the Bethlehem Shipbuilding Corporation at Sparrows Point, Md., on September 17, while the West Chopeka, a 12,000-ton freighter, will go down the ways of the Los Angeles Shipbuilding & Dry Dock Company, thus marking the launching of the last merchant ship for the Government.

To Be Oil Burner, Alameda, Cal.—The steam freighter Pacifico will be converted into an oil burner at the yards of Barnes & Tibbetts, this company having been the lowest bidder for the work. The barkentine Olympic, owned by Thomas Crowley, is also at the yards of Barnes & Tibbetts for docking and overhauling, as well as the steam schooner Alliance, recently purchased at a United States Marshal sale for about $2,300, which is being recalled and thoroughly overhauled.

Deck Machinery, Elizabeth, N. J.—The Moore Plant of the Bethlehem Shipbuilding Corporation will construct the deck machinery for a 2,650-ton oil tanker, contract for which has been awarded to the Bethlehem Shipbuilding Corporation, Ltd. This machinery will consist of a 7 by 7 inch Bethlehem spring quadrant type steering gear with horizontal engines and 8¼ inch by 8 inch Bethlehem spur gear windlass suitable for taking 1¾ inch anchor chain and a 6¼ by 8 inch Bethlehem steam self-contained gypsey.

Contract Awards, Hoboken, N. J.—The W. & A. Fletcher Company has been awarded the contract for engine repairs and for the general overhaul of the structure, equipment and tanks of the steamship William Ison, of the American Italian Commercial Corporation. It is expected this work will cost close to $19,000. The same company has been awarded the United Fruit Company ship Carrillo, for overhauling of sea valves, bottom repairs and painting, and the steamer Mystic of the United American Lines, for survey, bottom damage and trip repairs.

To Recondition Steamer, Port Arthur, Ont.—The Port Arthur Shipbuilding Company is reported to have a contract for overhauling and repairing the steel steamship Francis Widlar which was recently refloated by the Reid Wrecking Company, Sarnia, from Pancake Shoals, Lake Superior, where she was stranded in the fall of 1920. The vessel, with a length of 416 feet, breadth 50 feet and depth 28 feet, is of 4,682 gross tons. It is estimated that the work of reconditioning this steamer will occupy about three months' time, and will be under the supervision of John Smith, naval architect, Cleveland, Ohio, on behalf of the Mathews Steamship Company, Toronto.

Passenger Liner Wanted, Seattle, Wash.—The Admiral Line, L. C. Smith Building, is reported to be in the market for a passenger liner to replace the steamer Governor which sank in Puget Sound several months ago. According to A. F. Haines, vice president of the company, no vessel has been obtained as yet, but if a suitable vessel for the coastwise trade could be secured, it would be added to this service. Some time ago plans were drawn for two fast liners for this company, construction of which was to commence as soon as shipbuilding costs dropped, but no further action has been taken in this direction.

Pump Installation.—The M. T. Davidson Company, 154 Nassau Street, New York City, manufacturers of steam pumps, have been awarded the contracts for the installation of pumps on the Philadelphia fireboat Rudolph Blankenburg, being built by the John W. Sullivan Company, and also for the second Philadelphia fireboat, not yet named, being built by the Merchant Shipbuilding Corporation, Chester, Pa.

The equipment to be installed includes a vertical twin beam air pump, 14 inches by 24 inches by 24 inches by 15 inches; two vertical simplex boiler feed pumps; one horizontal simplex fire and bilge pump, and one horizontal simplex sanitary pump. For the New York fireboat John Purroy Mitchell, a vertical beam twin cylinder air pump and two vertical duplex boiler feed pumps are being supplied by the same company.

Activity at South Jacksonville, Fla.—The yard of the Gibbs Gas Engine Company, South Jacksonville, Fla., is showing increased activity with sixty percent of its normal working force re-employed and more being added. The company is building a sloop yacht for a prominent local business man. The vessel is to be one of the finest cruisers turned out in some time. The company is also doing a great deal of repair work and at present has in dry dock the motor houseboat North State which is being overhauled to be followed by the tug Pilot Boy for drydocking and general repairs to the hull, scraping and painting. As the southern yachting season is soon to open the company expects a number of steam and gas yachts from the north for overhauling, thus providing steady work for their full normal force. The company also expects to expand in the construction of small pleasure sail boats.

New Steamers Contemplated, Baltimore, Md.—That the construction of new steamers is contemplated by the Merchants and Miners Transportation Company, is one of the newest developments indicating improvement in the shipbuilding industry, according to official information obtained by Marine Engineering and Shipping Age. Advices received from A. D. Stebbins, president and general manager of the transportation company, state that the line will "undoubtedly have to build some steamers in the near future," although no definite plan has been determined upon as yet.

Robins Yard Gets "American Legion," Brooklyn, N. Y.—The Robins Dry Dock & Repair Company was awarded the contract for repairs to the United States Shipping Board steamer American Legion, bids for which were opened at 45 Broadway, New York, on Thursday, September 8. The tenders submitted were as follows: Robbins Dry Dock & Repair Company, $14,980; Standard Shipbuilding Corporation, $17,368; New York Harbor Dry Dock Company, $24,103; Morse Dry Dock & Repair Company, $25,500; W. & A. Fletcher Company, $30,080.

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CONSTRUCTION FOR NAVY

Vessels under construction for United States Navy and their degree of completion as reported August 31, 1921, by the Bureau of Construction and Repair, Washington, D. C., are as follows:

Type Number and Name	Contractor	Per Cent. of Completion Sept. 1, 1921 Total
BATTLESHIPS (BB)		
44 California	Mare Island Navy Yard	Comm.
45 Colorado	New York S. B. Corpn.	78.4
47 Washington	New York S. B. Corpn.	69.3
48 West Virginia	Newport News S. B. & D. D. Co.	61.
49 South Dakota	New York Navy Yard	34.1
50 Indiana	New York Navy Yard	31.2
51 Montana	Mare Island Navy Yard	27.3
52 North Carolina	Norfolk Navy Yard	36.5
53 Iowa	Newport News S. B. & D. D. Co.	29.
54 Massachusetts	Beth. S. B. Corpn. (Fore River)	10.4
BATTLE CRUISERS (CC)		
1 Lexington	Beth. S. B. Corpn. (Fore River)	24.2
2 Constellation	Newport News S. B. & D. D. Co.	13.3
3 Saratoga	New York S. B. Corpn.	27.4
4 Ranger	Newport News S. B. & D. D. Co.	2.5
5 Constitution	Philadelphia Navy Yard	10.7
6 United States	Philadelphia Navy Yard	10.4
SCOUT CRUISERS (LIGHT CRUISERS CL)		
4 Omaha	Todd D. D. & Const. Corpn.	94.6
5 Milwaukee	Todd D. D. & Const. Corpn.	92.4
6 Cincinnati	Todd D. D. & Const. Corpn.	87.1
7 Raleigh	Beth. S. B. Corpn. (Fore River)	63.7
8 Detroit	Beth. S. B. Corpn. (Fore River)	66.3
9 Richmond	Wm. Cramp & Sons Co.	70.
10 Concord	Wm. Cramp & Sons Co.	66.
11 Trenton	Wm. Cramp & Sons Co.	50.
12 Marblehead	Wm. Cramp & Sons Co.	46.
13 Memphis	Wm. Cramp & Sons Co.	40.
AUXILIARIES		
Fuel Ship No. 18, Pecos (Oiler AO6)	Boston Navy Yard	Comm.
Repair Ship No. 1, Medusa (AR1)	Puget Sound Navy Yard	68.
Dest. Tender No. 3, Dobbin (AD3)	Philadelphia Navy Yard	66.3
Dest. Tender No. 3, Whitney (AD4)	Boston Navy Yard	32.8
Sub. Tender No. 3, Holland (AS3)	Puget Sound Navy Yard	21.5
Aircraft Tender, Wright (AZ1)	Tietjen & Lang	90.
PATROL VESSELS		
Gunboat No. 22, Tulsa (PG22)	Charleston Navy Yard	70.6
Authorized but not under construction or contract. (1) Transport No. 2.		
DESTROYERS		
338 Wasmuth	Mare Island Navy Yard	99.2
339 Trever	Mare Island Navy Yard	97.3
340 Perry	Mare Island Navy Yard	71.6
341 Decatur	Mare Island Navy Yard	65.4
Destroyers authorized but not under construction or contract. (12) Nos. 348 to 359 inclusive.		
SUBMARINES		
115 S-10	Portsmouth, N. H., Navy Yard	93.6
116 S-11	Portsmouth, N. H., Navy Yard	91.1
117 S-12	Portsmouth, N. H., Navy Yard	89.3
118 S-13	Portsmouth, N. H., Navy Yard	86.6
123 S-18	Electric Boat Co. (Quincy)	97.
124 S-19	Electric Boat Co. (Quincy)	96.5
125 S-20	Electric Boat Co. (Quincy)	98.5
126 S-21	Electric Boat Co. (Quincy)	94.9
127 S-22	Electric Boat Co. (Quincy)	95.8
128 S-23	Electric Boat Co. (Quincy)	94.
129 S-24	Electric Boat Co. (Quincy)	93.
130 S-25	Electric Boat Co. (Quincy)	93.5
131 S-26	Electric Boat Co. (Quincy)	92.4
132 S-27	Electric Boat Co. (Quincy)	91.
133 S-28	Electric Boat Co. (Quincy)	91.6
134 S-29	Electric Boat Co. (San Fran.)	90.5
136 S-31	Electric Boat Co. (San Fran.)	97.5
137 S-32	Electric Boat Co. (San Fran.)	95.9
138 S-33	Electric Boat Co. (San Fran.)	99.2
139 S-34	Electric Boat Co. (San Fran.)	95.2
140 S-35	Electric Boat Co. (San Fran.)	92.5
141 S-36	Electric Boat Co. (San Fran.)	89.2
142 S-37	Electric Boat Co. (San Fran.)	86.6
143 S-38	Electric Boat Co. (San Fran.)	80.
144 S-39	Electric Boat Co. (San Fran.)	75.1
145 S-40	Electric Boat Co. (San Fran.)	74.6
146 S-41	Electric Boat Co. (Quincy)	77.8
153 S-42	Electric Boat Co. (Quincy)	72.6
154 S-43	Electric Boat Co. (Quincy)	73.1
155 S-44	Electric Boat Co. (Quincy)	71.1
156 S-45	Electric Boat Co. (Quincy)	71.8
157 S-46	Electric Boat Co. (Quincy)	70 3
158 S-47	Lake T. B. Co. (Bridgeport)	69.7
159 S-48	Lake T. B. Co. (Bridgeport)	96 2
160 S-49	Lake T. B. Co. (Bridgeport)	92.2
161 S-50	Lake T. B. Co. (Bridgeport)	89.4
162 S-51	Lake T. B. Co. (Bridgeport)	84.6
FLEET SUBMARINES		
60 T-2 (SF 2)	Electric Boat Co. (Quincy)	99.3
163 V-1 (SF 4)	Portsmouth, N. H., Navy Yard	3.7
164 V-2 (SF 5)	Portsmouth, N. H., Navy Yard	3.7
165 V-3 (SF 6)	Portsmouth, N. H., Navy Yard	3.7

Note: Submarines authorized but not under construction or contract.

Fleet submarines (6) Nos. 166 to 171.
Neff submarine (1) No. 108.

To Recondition Steamer, New York.—Tenders for reconditioning the steamship Olympe, the specifications covering two separate items, one for the installation of a new 'tween deck and another for watertight bulkheads and general overhauling, were opened on August 24, at the office of Cozins & Petrie, marine engineers, 42 Broadway, New York. The figures submitted have been forwarded to the owners in France and a decision on the awarding of the contract is expected in the near future. The prices submitted are as follows: Standard Shipping Corporation (A) $62,955—35 days, (B) $57,874—33 days; Todd Shipyards Corporation (A) $71,230—30 days, (B) $67,100—30 days; Jas. Shewan & Son (A) $74,545—30 days, (B) $66,630—30 days; Morse Dry Dock & Repair Co. (A) $80,000—35 days, (B) $66,000—35 days; Ira Bushey & Son (A) $86,206—36 days, (B) $79,426—36 days; National Dry Dock Co. (A) $109,000—55 days, (B) $99,441—55 days.

Subchasers to be Converted into Yachts, Seattle, Wash.—H. K. Schell, naval architect, of Seattle, has prepared designs for the conversion of two submarine chasers into high speed pleasure yachts. One of the vessels, purchased from the Navy by G. H. Withy, of Vancouver, B. C., is undergoing alterations at the old Meacham & Babcock yard, Seattle, and the other bought by Los Angeles interests, at the plant of the Blanchard Boat Company, Lake Union, Wash. The original cost of the craft in each instance is estimated at close to $122,000, and their conversion will involve the expenditure of about $40,000 each. Alterations and repairs to the engines of both vessels are being undertaken by Messrs. McKechnie & Hamilton, experts on yachting engines and motors.

New Pleasure Yacht, San Francisco, Cal.—A new pleasure yacht to have Diesel electric drive is being constructed for G. Allan Hancock, millionaire oil magnate, of Los Angeles. The vessel is 132 feet long, 20 feet wide and 7 foot draft, with a straight stem and cruiser stern. She is to be finished throughout with hardwood and is to be a floating palace when completed, according to plans of the builder. The machinery installation consists of two six-cylinder Winton Diesel engines, each directly connected to a 90-kilowatt 125 volt direct current generator turning at 450 revolutions per minute. The main driving motor is a 215 shaft horsepower 250 volt double armature model, turning the propeller shaft at 275 revolutions per minute, and is expected to develop a speed of about nine or ten knots. The vessel will be heated and lighted by electricity, and all cooking is to be done by means of electricity as well.

Fletcher Company Contracts, Hoboken, N. J.—Contracts for dry docking and general overhauling and renewal of plates in the steamship Ed. V. Harkness, of the Standard Oil Company of New Jersey, and dry docking and general overhauling of the steamship Winamac, of the Standard Oil Company of New York, have been awarded to the W. & A. Fletcher Company. The total amount involved will be close to $10,000. The same company also has the steamship Acropolis, operated by Stephen D. Stephenitis, 24 State street, New York, for voyage repairs. The Shipping Board steamer Osakis was awarded to the Fletcher Company for the installation of a new tail shaft, dry docking, and considerable engine and bottom work at a price of approximately $3,000.

To Convert Bermuda Liner, Quincy, Mass.—The Bethlehem Shipbuilding Corporation, Fore River Yard, with a price of $44,000, was the low bidder for the steamship Fort St. George, of the Furness-Bermuda Line, to be converted from coal to oil burning, the bids for which were opened recently. Other bidders were: New York Harbor Dry Dock Company, $53,417; Standard Shipbuilding Corporation, $55,433; Robins Dry Dock & Repair Company, $68,823; Newport News Shipbuilding Company, $70,300; James Shewan & Sons, $77,500; Morse Dry Dock & Repair Company, $80,275; W. & A. Fletcher Company, $105,000.

Three Ships Needed, Seattle, Wash.—The possibility of three vessels for lines operating on the west coast is seen in the announcement from Seattle that plans are being considered by the Poulsbo Transportation Company for the purchase or construction of a steamer to replace the steamship Athlon, which went ashore near Point Ludlow, Puget Sound, recently; from the same place the Alaska Steamship Company is reported as investigating the field with a view of acquiring another vessel to replace the wrecked steamship Alaska, which went aground off the Oregon coast, and from the Gray's Harbor Dredging Company, of Aberdeen, Wash., that it will salvage the wrecked steamer Canadian Explorer, operated by the Canadian Government and valued at $500,000, which is lying off the Washington coast broken in two from having gone on the rocks.

PORT IMPROVEMENTS

Ship Canal, Chile.—The Government of Chile has under consideration the construction of a ship canal from Talcahuano to Concepcion.

Wharves, Mobile, Ala.—The City Commission is receiving bids on repairs to the bulkheads and wharves at the foot of Dauphin street, involving the expenditure of about $10,000.

Seawall, Barnegat, N. J.—The State Department of Commerce and Navigation, Trenton, N. J., plans to build a concrete seawall at Barnegat to cost about $25,000. For further information address R. F. Engle, Beach Haven, who is a member of the board.

Dredging, Filling, Etc., Sarasota, Fla.—A. B. Edwards, mayor, has let a contract to the Burns Dredging Company, to fill, dredge and bulkhead the harbor at Hog Creek.

Canal, Canada.—The Department of Railways and Canals, Parliament Building, Ottawa, Canada, has let a contract for building sections 1 and 2 of the Welland Ship Canal to J. P. Porter & Company, Pickford & Black's Wharf, Halifax, N. S. This work involves the expenditure of about $8,000,000.

Warehouse, Galveston, Tex.—The Galveston Wharf Company has awarded a contract to M. C. Bowden for the construction of additional cotton warehouse facilities to provide space for 90,000 bales.

Canal, Lake Charles, La.—The Calcasieu Parish Police Jury will construct a deep water canal to connect Lake Charles with the Sabine River and the Gulf of Mexico. A bond issue in the amount of $2,750,000 to cover the cost of this project will be voted upon November 8.

Dredging, Barnegat, N. J.—Victor Gelineau, Director, Board of Commerce and Navigation, State House, Trenton, N. J., will receive sealed proposals until 12 o'clock noon (daylight saving time) Tuesday, October 4, for dredging a section of the proposed inland waterway connecting Barnegat Bay with the Manasquan River, for which the sum of $50,000 is available. Further information may be obtained upon application.

Dock Equipment, Oakland, Cal.—Freight handling equipment, including loading and unloading machinery, hoisting equipment, etc., will be installed on the new dock to be constructed by the Board of City Commissioners, which is estimated to cost $100,000. Albert E. Carter, city commissioner, is in charge.

Dredging, Improving Pier, Jacksonville, Fla.—It is announced by the city commission that John Emil has been awarded the contract for dredging the slips at the Jacksonville terminal to 30 feet depth. Pier No. 2 is being improved and permanently prevented from settling by the driving of a number of piles to a depth of 45 feet upon the tops of which a retaining platform has been built.

Docks, Wharves, Etc., Norfolk, Va.—Charles E. Ashburner, manager, contemplates a bond issue for the development of the waterfront property, including the erection of a grain elevator of 1,000,000 bushels capacity, as well as docks, wharves and warehouses. This project is estimated to cost between $3,000,000 and $4,000,000.

Pier and Platform, New York.—Contract No. 1694.—Commissioner M. Hulburt, of the Department of Docks, Pier A, foot of Battery Place, North River, New York, has let a contract for building the pier and platforms on the outshore portion of Brooklyn Bridge improvement, Borough of Manhattan, to G. B. Spearin, Inc., 90 West street, New York, at a price of $322,236.

Canal, Etc., Columbia, S. C.—The Columbia Railway & Navigation Company, Columbia, S. C., has plans for the construction of a new hydroelectric generating plant on a canal to be constructed connecting the Santee and Cooper Rivers, with an initial capacity of about 30,000 horsepower. The entire project is estimated to involve the expenditure of about $5,000,000. G. A. Guignard is president of the company.

Extensive Harbor Improvements, San Diego, Cal.—According to a recent announcement harbor improvements calling for the expenditure of several hundred thousand dollars are to be made jointly by the Santa Fe Railway Company and the Spreckels

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Brothers Commercial Company. The greater part of the money will be applied to the reconstruction of the east and west Santa Fe wharves and in other improvements to the railway company's deep-water terminal.

To Start Work on Pier, Hoquiam, Wash.—The Grays Harbor Port Commission received bids September 13 for all pile driving and timber construction on the first unit of pier No. 1 at Cow Point. The work includes the furnishing of all material and labor in the construction of 167,000 square feet of pile and timber wharf, or approximately 195,000 linear feet of piles, 2,905 pieces; 1,974,000 f. b. m. lumber and 84,000 pounds of iron.

To Buy Harbor Site, Norfolk, Va.—Three possible sites for the location of a small boat harbor were offered to the Port Commission. These parcels of land are the Norfolk Warehouse Corporation's property on Front street, Atlantic City, the Old Dominion Terminal property which belongs to the Homes Corporation, lying between the Norfolk and Western piers and Tarrant's Creek, and the property at Tarrant's Creek belonging to Robert D. Davis and others. All three properties will be appraised by a board of appraisers, to be appointed within a few days, and their results reported to the Port Commission at a later meeting.

New Pier Probable, Hoboken, N. J.—The construction of a new large concrete pier, fitted with modern equipment, to replace the waterfront property at the U. S. Army base, destroyed by fire on August 25 and 26, was considered very probable in marine circles today. As a result of the fire, Pier 5 was totally destroyed; pier 6 was estimated as a 25 percent loss; and two buildings were totally burned. No authentic figures on the extent of the damage could be obtained, although it was stated a board of officers is conducting an investigation. According to information obtained by Marine Engineering and Shipping Age, the Government has for some time past considered the advisability of erecting a new concrete pier at this point, and it is believed the burning of the old piers will facilitate the carrying out of previous plans.

$10,000,000 Port for Newark, N. J.—It is announced that the city of Newark will spend $10,000,000 on a port terminal which is intended to convert the west shore of Newark Bay into an ocean port capable of docking the largest cargo and passenger steamers. The port's chief asset is its facilities for transferring freight direct from railroad to water carrier. The city has already spent $4,400,000 on the bay front development, including current contracts, and there is an additional appropriation of some $400,000 available now for a portion of the new work contemplated. It is the policy of the city government to expend in the neighborhood of some $5,000,000 more eventually on piers, warehouses, a city-owned railroad, classification yard, more highways leading through the mass of industrial sites in the port area and other improvements.

May Spend Millions in New York Harbor.—The Edge-Ansorge Bill for harbor development was signed on August 23, by President Harding, thus assuring cooperative effort between the Federal Government and the States of New York and New Jersey to insure the proper development of New York harbor as proposed by the Joint Commission of New York and New Jersey in the treaty entered into by the two States on April 30, 1921, for the purpose of relieving congestion in the harbor. Tentative plans contemplate the construction of an automatic electric system with joint terminal stations for the expeditious distribution of food-stuffs and other merchandise. Other improvements proposed include the establishment of free ports, construction of wider piers and more warehouse facilities at the congested points, the dredging of channels to every part of the port's waterfront, the development of a belt line railroad system around the port, erection of grain elevators, construction of additional terminals for the New York Barge Canal and the construction of highway access to every part of the port's waterfront. The fulfilment of these plans will relieve congestion and expedite and cheapen the distribution of foodstuffs and materials in and through the entire port district and to points throughout the country.

GOVERNMENT WORK

Operating Building, Port Arthur, Tex.—Specifications 4511. The Bureau of Yards and Docks, Navy Department, Washington, D. C., plans to construct an operating building at Port Arthur.

Boiler Plant Improvements, Annapolis, Md.—Specification 4500. The Bureau of Yards and Docks, Navy Department, Washington, D. C., will soon receive bids for boiler plant improvements at the Naval hospital.

Heating System, Etc., Norfolk, Va.—Specification 4512. The Bureau of Yards and Docks, Navy Department, Washington, D. C., plans to alter and build an addition to the underground heating and drainage systems for the electrical distributing system at Norfolk.

Refrigerator Equipment, Newport, R. I.—Specification 4499. The Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive bids for the installation of refrigerating equipment.

Boiler Plant Equipment, San Diego, Cal.—Specification 4494. The Bureau of Yards and Docks, Navy Department, Washington, D. C., will soon receive bids for boiler plant equipment to be installed at San Diego.

Dredging, New Haven, Conn.—The United States Engineer, Providence, R. I., has let a contract for dredging in New Haven Harbor, to the J. S. Packard Dredging Company, 104 Turks Head Building, Providence. This work involves the expenditure of about $40,000.

Dredging, New Jersey.—The United States Engineer, 2nd District, Room 616, Army Building, New York City, has let contracts for dredging in the Shrewsbury River and Keyport Harbor, N. J., to J. P. Randerson, 51 State street, Albany, N. Y., and the Taylor Dredging Company, Communipaw avenue, Jersey City, N. J., the contracts amounting to $14,900 and $11,225, respectively.

NEW INCORPORATIONS

The Montreal Boatbuilders, Ltd., Lachine, Quebec, Can., has been incorporated under the Dominion Companies Act with a capital of $100,000 to build, deal in and operate ships of every description, wharves, piers, docks, warehouses, etc. W. S. Johnson, A. R. Hall, E. M. Pierce, J. Edward and R. R. Larabee, Montreal, are the incorporators.

The North Shipping Company, Ltd., and the South Shipping Company, Ltd., with offices at Quebec, Que., Can., have been incorporated under the Dominion Companies Act with a capital of $500,000 each, to carry on a passenger, mail and freight transportation business, as well as towing and wrecking, etc., in any navigable water in and bordering on the Dominion, and to and from any foreign port. These companies are said to be subsidiaries of the Clark Steamship Company. A. C. and H. P. Hill, C. H. MacLaren, S. A. V. Martin, and L. Mattman, Ottawa, are the incorporators.

The H. W. Sweet Shipyard & Machine Works, Inc., Greenport, N. Y., was recently incorporated with a capital of $75,000 by H. W. Sweet, F. B. Corey and C. W. Thorn, to operate a shipbuilding plant and general machine construction and repair works.

FOREIGN ACTIVITIES

Ships for German Line.—It is reported that Messrs. Blohm & Voss, Hamburg, Germany, have been awarded a contract by the Hamburg-American Line to build three passenger steamers, each of 22,000 tons, and eight Diesel-engined vessels of 6,000 tons.

New Shipping Company Formed in Germany.—The Nordland Handels u. Schiffahrt, A. G., Hamburg, has been established with a capital of 100,000 marks to engage in shipping and allied business, particularly with Scandinavian countries. Herr Bergh, of Sweden, is director of the new concern.

To Convert Yacht, Germany.—The steam yacht Lensahm, formerly owned by the Archduke von Oldenburg, was recently sold to the firm of Wilhelm Börstler & Company, Hamburg. The vessel will be converted for commercial service, and has been sent to the Frankesche Werft at Reiherstieg.

Danish Shipping.—According to reports from Copenhagen, there has been a decided improvement in Danish shipping since the settlement of the coal strike in England. During the last six weeks 8,000 tons of shipping that had been laid up have again come into operation, out of a total of 283,000 tons, or 107 ships.

New Ship Service by Norwegian Firm.—The North and South Atlantic Line of Bergen will shortly open a new service between New Orleans and the principal ports of Mexico in competition with American ships. Vessels of 2,400 tons will be placed on this route.

To Improve Port, Russia.—It is reported that the port of Reval is being extensively enlarged and that all modern improvements will be introduced in order to facilitate trade with Russia.

New Dry Dock, Holland.—The Amsterdam Dry Dock Company is said to have placed an order recently with the Netherlands Shipbuilding Company of Amsterdam for its fifth floating dry dock which will be the largest in the Amsterdam harbor. It will be capable of lifting 25,000 tons; will be 650 feet in length, electrically lighted and driven, and provided with compressed air apparatus.

London to Have Ship Repair Yard.—When the firm of Harland & Wolff takes over, in addition to its present yards at Belfast, Govan and Greenock, by the authority of the port of London, all the port maintenance work and a large proportion of the engineering and repairing staffs, numbering 1,000, thus extending the Thames side of its works, London will have ample facilities for repairing the largest transatlantic liners which previously were not able to berth at this port. The company plans to provide extensive workshops, both afloat and ashore, to cost more than a quarter of a million dollars, as a sequel to the inauguration last July of a new drydock capable of accommodating most of the biggest liners.

Mauretania to Be Oil Burner, Wallsend.—It is announced that Swan, Hunter & Wigham Richardson, Ltd., Wallsend on Tyne, builders of the Mauretania, has received a contract from the Cunard Line to convert this vessel into an oil burner, at the same time making repairs necessitated by the recent fire on board the vessel. The job is estimated to take about six or seven months. This will make a total of six vessels using oil fuel in the combined fleet of the Cunard-Anchor Lines. All of the new fleet of eighteen vessels ordered since November, 1918, will also be oil fueled.

British Resume Shipbuilding Work—It is announced that on September 25 the Government dockyards resumed building activities on full time. The Cunard Company has also ordered resumption of work on three of the five vessels being built for the company on the Tyne, two of which ships have already been launched. The Cunard Line is building ten vessels for the transatlantic trade.

Activity at Palmer Yards, England.—During the last nine weeks there were five vessels launched from the several yards of the Palmer Shipbuilding Company at Jarrow, Amble and Hebburn, the most recent launching being that of the 10,000-ton passenger and freight steamer Meriones for the Ocean Steamship Company of Liverpool, from the yard at Hebburn. A 500-ton steel tank barge for the Buenos Aires station of the Anglo-American Petroleum Company was launched from the ways of the Amble yard. The company is said to have a good deal of work on hand and is making steady progress toward the completion of a variety of vessels.

River Boat Building for Roumania.—According to recent reports, there seems to be an opportunity in Roumania for the employment of many more river craft. Although on account of present economic conditions it may be difficult to sell such boats to Roumanian purchasers, arrangements might be made to extend credit on terms, or to take an interest in navigation companies to be formed for the purpose of supplying some of the deficiency in transport.

New Steamship Service, Spain—It is announced that a new steamship service between Santander and New Orleans, calling at Havana and Vera Cruz, has been established, the first vessel sailing from Santander in September.

Welland Canal Contract—J. P. Porter, Halifax, N. S., was awarded the contract for sections 1 and 2 of the new Welland Canal, comprising the work between Lake Erie and Lake Ontario, a distance of seven miles, the cost of which is estimated at $8,000,000. Contracts for sections 3 and 4 will soon be awarded by the Department of Railways and Canals, and work on section 5 is already being done under contract. With the completion of this work the canal, which is to consist of seven locks, will be able to accommodate vessels of 14 feet draft, and when the portion of the canal from the end of section 5 into Lake Erie has been deepened, vessels of 12,000 tons will be able to pass from Port Arthur to Kingston, at the foot of Lake Ontario.

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BUSINESS NOTES

The Babcock & Wilcox Company, 85 Liberty Street, New York, manufacturers of water-tube boilers for land and marine service, has opeend a marine office in the Guardian Building, Cleveland, Ohio, and will be represented by Mr. John Coleman, who has been connected with the Babcock & Wilcox Company for over twenty years.

The Engineer Company, 17 Battery Place, New York, has secured the exclusive rights for the manufacture and sale of the improved standard navy burner (Starr patent) and the air register (Purnell patent) developed by Lieutenant-Commander Purnell, who was recently in charge of the United States Navy Fuel Oil Testing Plant at the League Island Navy Yard, Philadelphia, Pa. These products will be marketed under the commercial names of "Enco" burner and "Enco" register.

The Thacher Propeller & Foundry Corporation announce the engagement by them of Mr. F. V. Archer, formerly manager of Naumburg & Company, New York, Boston, Philadelphia, etc., who has assumed the duties of vice-president in charge of finance, cost, expenditures, etc. Mr. Archer is particularly well experienced in the qualifications necessary to his new duties, having had charge of analysis and finance for some of the largest American industries. He assumed his new duties September 1, with headquarters at the main office in Albany, N. Y.

It is announced that Lykes Brothers, Inc., one of the largest operators of United States Shipping Board vessels in this country, have opened a steamship office in Tampa, Fla., as they propose to operate vessels in the phosphate trade from Tampa.

The Goetze Gasket & Packing Company, New Brunswick, N. J., announces the opening of a branch office at Philadelphia, Pa., in the Drexel Building, 5th and Chestnut streets, under the management of the Sheffler-Gross Company.

Contract for Navy Cranes

The Navy Department has awarded a contract to The McMyler-Interstate Company for two 50-ton dry dock cranes, one crane to be erected on the dry dock at South Boston and one on the new dry dock at Puget Sound Navy Yard at Bremerton, State of Washington.

The amount of the contract for the two cranes is about $310,000. The crane for South Boston is to be completed in 250 days and the crane for Puget Sound is to be completed in 280 days. The cranes will be steam operated and will travel on rails having a gage of about 22 feet, with 16 wheels on each side. The cranes are of the traveling, revolving type with a movable jib or boom. They have a capacity of 50-gross tons at a maximum radius of 90 feet 6 inches on the main hoist and a capacity of 15 gross tons at a maximum radius of 129 feet 6 inches on the auxiliary hoist.

TRADE PUBLICATIONS

Lighting Data.—Pamphlets containing information on reflectors for incandescent lamps and ship lighting have been compiled by A. B. Oday and A. S. Turner, Jr., of the lighting service department, Edison Lamp Works, General Electric Company, Harrison, N. J. The paper on reflectors gives a general discussion of their use, materials, types, efficiencies and also contains data sheets of the characteristics of each type. The pamphlet on ship lighting states the requirements to be met for wiring and fixtures and gives illustrated examples of lighting in various sections of the ship.

Metal Spraying Process.—The process for depositing a coating of metal on nearly all manner of materials known as the Schoop metal spraying process is outlined in a pamphlet issued by the Metals Coating Company of America, 495-497 North Third street, Philadelphia, Pa. The scientific development of this process, a description of the machines used and the range of application are fully described.

Condensers.—A general catalogue illustrating condensing equipment and auxiliaries has been sent out by the Wheeler Condenser and Engineering Company, Carteret, N. J. Equipment for both stationary and marine service are described. Special attention is called to a new design 26-inch vacuum surface condenser which dispenses with auxiliary pumps; the Wheeler steam jet air pump with combined inter-condenser and heater; the Wheeler jet condenser with expansion joint between condenser body and turbine.

New York Shipbuilding Corporation Record.—The record of ships built by the New York Shipbuilding Corporation, Camden, N. J., has been published and is now being distributed. "Craftsmanship, developed through years of steadfast adherence to the highest standards of character, is reflected in the performance of the ships built. Their service, the diversity of experience gained in the construction of every type vessel, and the firm foundation of sound shipbuilding methods and unequalled plant facilities of this great shipyard during the twenty-one years of its existence—passenger liners, tankers, colliers, superdreadnoughts, destroyers, general cargo vessels, river steamers, lightships, revenue cutters, fire boats—each type has contributed its share to the complete experience of the yard." From the earliest ships built to the latest battleship and passenger liner constructed, the work of the yard as given in this book is a wonderful example of accomplishment in American Shipbuilding.

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